Time-Dependent Mood Fluctuations in Antarctic Personnel: A Meta-Analytic Review

By

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Statement of Sources

I declare that this report is my own original work and that contributions of others have been duly acknowledged.

Signed:

Date:

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Abstract

The third-quarter phenomenon is the dominant theoretical model to explain the psychological impacts of deployment in Antarctica on personnel. It posits that detrimental symptoms to functioning, such as negative mood, increase gradually throughout deployment and peak at the third-quarter point, regardless of overall deployment length. However, there is equivocal support for the model. The current meta-analysis included data from 20 studies (involving 1817 participants) measuring negative mood during deployment to elucidate this discrepancy. Across studies analyses were conducted on three data types; stratified by month utilising repeated-measured all time-points meta-analytic techniques, and pre/post deployment data for summer and winter deployment seasons respectively. Moderation analyses were conducted to investigate the impact of personnel's cultural orientation on functioning. Results did not support the proposed parameters of the third-quarter phenomenon, as negative mood did not peak at the third quarter point (August/September) of deployment. Overall effect sizes indicated that negative mood is greater at baseline than the end of deployment for summer and winter deployment seasons, with the direction of this effect influenced by cultural orientation of personnel. These findings have theoretical and practical implications and should be used to guide future research, assisting in the development and modification of pre-existing prevention and intervention programs to increase well-being and functioning of personnel during Antarctic deployment.

Antarctica is one of the most extreme and unusual environments (EUEs) on Earth (Suedfeld & Steel, 2000). This places the individuals who inhabit it outside the optimal physical, social, and psychological parameters for human functioning and survival (Paulus et al., 2009). The impact of Antarctic parameters on deployed personnel's adaptation and functioning has been extensively documented (for a review see Zimmer, Cabral, Borges, Côco, and Hameister (2013)). This research holds utility in the selection and support of personnel during deployment in Antarctica, and pronounced scientific value for behavioural scientists more generally, providing insight into human adaptation and functioning under stress and exceptional physical, social, and psychological circumstances (Suedfeld, 1998).

Researchers have demonstrated psychological parameters associated with Antarctic deployment to have a disproportionately larger impact on human adaptation and functioning than physical and social factors (Jenkins & Palmer, 2003). This has resulted in a body of literature investigating the impacts of Antarctic deployment on psychological functioning (Lilburne, 2005), including time-dependent fluctuations in mood (herein referred to as mood fluctuations) during Antarctic deployment. The dominant theoretical model used to investigate these mood fluctuations is termed the third-quarter phenomenon, which posits negative mood gradually increases throughout deployment, peaking at the third-quarter point, regardless of overall deployment length (Bechtel & Berning, 1991). However, there is a clear discrepancy in the literature surrounding when, if at all, the specific psychological sequelae experienced in Antarctica are detrimental to personnel mood during deployment (Shea et al., 2011). This brings into question the validity of the third-quarter phenomenon as a theoretical model to investigate the impacts on mood in Antarctic personnel.

Based on these discrepancies, this thesis examined the inconsistencies in research surrounding mood fluctuations in Antarctic personnel. It examined pre-existing empirical data via meta-analytic techniques to elucidate whether there is a critical phase in deployment where mood significantly deteriorates, and if so, whether these psychological effects can be identified across personnel of different cultures deployed in Antarctica.

Antarctica as an Extreme and Unusual Environment (EUE)

Every year, Antarctica is inhabited by approximately 4800 personnel from 28 National Antarctic Programs (Council of Managers of National Antarctic Programs, 2014). The majority of personnel are deployed during the 'peak' summer deployment period (October to March), whilst a smaller 'winter-over crew' is deployed during the winter deployment period (March to October) (National Science Foundation, 2014). The physical, social, and psychological parameters experienced by Antarctic personnel are significantly removed from those experienced in routine environments inhabited by the majority of human communities, as well as those required for optimal functioning and survival.

The physical parameters of Antarctica and the associated impacts on human adaptation and performance are readily identifiable (Sandal, Leon, & Palinkas, 2006). Antarctica is identified as the earth's coldest, highest, driest, and windiest continent, with temperatures ranging between -10^{o} C at the coastline to -60^{o}C at the interior, and winds recorded at up to 327 kilometres per hour (Australian Antarctic Division (AAD), 2015b). Further, inhabitants experience extreme light/dark cycles, with prolonged periods of sunlight or darkness throughout the year (AAD, 2015). Antarctica's harsh environment makes human life impossible to sustain without specialist training, advanced technology and capsule life-support systems (Norris, 2010).

The social parameters experienced in Antarctica are sparse in comparison to routine environments in which individuals have the opportunity to socially interact with a variety of people across diverse contexts and settings (Suedfeld & Steel, 2000). This is due to forced interaction with a small number of unchanging, largely homogeneous personnel with whom an individual spends both work and leisure time (Barbarito, Baldanza, & Peri, 2001; Nicolas, Suedfeld, Weiss, & Gaudino, 2015). Furthermore, whilst in Antarctica, individuals have a prolonged period of limited contact with established social supports, such as family and friends (Palinkas, 2002). The forced social interactions and isolation from established social supports have been reported as a major stressor by deployed personnel, resulting in detrimental impacts upon psychological functioning (Palinkas, Cravalho, & Browner, 1995).

The psychological parameters influencing adaptation and functioning in Antarctica are influenced via the individual's perception, interpretation and response to the situation, rather than the external environment alone (Barnett & Kring, 2003). Researchers have documented a specific pattern of psychological response to Antarctic deployment characterised by alterations in mood, irritability and hostility, increases in psychosomatic complaints, insomnia, fatigue, cognitive impairment including deficits in memory and concentration, occurrences of mild hypnotic states termed 'long eye' or 'Antarctic stare', and a general apathetic state (Jenkins & Palmer, 2003). Although not a clinical entity (as severity and duration of symptoms are not sufficient to warrant a DSM-5 diagnosis), this phenomenon has been described as a subclinical condition, due to similar impacts on functioning as subclinical depression (Palinkas & Suedfeld, 2008). As there is no specific validated scale to measure these symptoms, research investigating the impacts upon Antarctic personnel have utilised a wide range of clinically validated psychological assessment scales having a common correlate of assessing mood. Although it is questionable as to whether these measures truly provide insight into negative mood, as the data provides only a snapshot of an individual's state on the day it is administered rather than a feeling of notable duration, the term 'negative mood' is predominantly used when describing this phenomenon in literature. Therefore, the current thesis also used the term 'negative mood' when referring to the outcome measured on these scales.

The term 'third-quarter phenomenon' has been used to describe this phenomenon, as symptoms have been observed to gradually increase over time, reaching a peak during the third-quarter of deployment regardless of the overall length of deployment (Jenkins & Palmer, 2003). However, despite receiving a notable amount of attention, there is substantial debate in the empirical literature surrounding whether mood fluctuations displayed in Antarctic personnel are consistent with the critical phases proposed in the third-quarter phenomenon (Bhargava, Mukerji, & Sachdeva, 2000; Zimmer et al., 2013).

The Third-Quarter Phenomenon

Bechtel and Berning (1991) undertook a narrative review of literature investigating psychological changes in personnel deployed in a range of EUEs, including Antarctica. It was identified that across EUEs a similar pattern of mood fluctuation existed, reaching its lowest point around the three-quarter mark of the total mission duration (Connors, Harrison, & Akins, 1985; Kanas & Fedderson, 1971). Based on this review, the third-quarter phenomenon was defined as a period of distress, which occurs during the third-quarter of a fixed term of isolation, regardless of length (Bechtel & Berning, 1991). For example, mood would reach its lowest point at 16 weeks for a 6-month deployment, and at the 8-month point in a 12-month deployment (Steel, 2016). Despite finding preliminary support for the third-quarter phenomenon, Bechtel and Berning (1991) acknowledged their review alone was insufficient to state the existence or universality of this phenomenon, thus recommending further research in this regard.

The Third-Quarter Phenomenon in Antarctica

As the third-quarter phenomenon has been proposed to occur in fixed-term situations of isolation and stress, Antarctica is an optimal environment to study the existence of this phenomenon. The winter deployment period (March to October) has been predominately utilised when investigating the third-quarter phenomenon in Antarctica, arguably due to greater challenges to the adaptation and functioning of personnel in comparison to the summer deployment period. The challenges include a significantly smaller population of personnel on the research bases with whom to interact (Appendix A) and more extreme weather conditions, temperatures, and light/dark cycles (AAD, 2015). To be consistent with the definition of the third-quarter phenomenon, a significant increase in negative mood would need to be identified in August/September, as this would be the third-quarter point of winter deployment periods.

Several studies have demonstrated support for the third-quarter phenomenon in Antarctic personnel. Steel (2001) observed a rise in negative mood, including anger, depression and confusion in the third-quarter of expedition length, persisting until the end of deployment in nine winter personnel located at the New Zealand Antarctic base. Similarly, Sandal (2000) observed a decrease in optimism and wellbeing and an increase in aggression levels in a group of 18 Scandinavian personnel deployed in Antarctica over the Austral summer at the third-quarter of their stay. These findings are consistent with the critical phases proposed by Bechtel and Berning (1991) and suggest the third-quarter phenomenon can be identified in personnel deployed in both winter and summer.

In contrast, other studies have indicated that mood fluctuations (consistent with symptoms associated with the third-quarter phenomenon) occur outside the third-quarter of the deployment duration. Palinkas, Gunderson, Johnson, and Holland (1999) observed a significant increase in mood disturbance scores during the second half of winter, in contrast to the first half of winter, in an American cohort. Palinkas et al. (1999) concluded that the increase in mood disturbance scores supported the existence of the third-quarter phenomenon. However, as these results showed the peak of mood deterioration occurred and stayed persistent from the halfway point of deployment, these findings are instead inconsistent with the parameters of the third-quarter phenomenon (Barbarito et al., 2001). Mood fluctuations inconsistent with the parameters of the third-quarter phenomenon were also found by Barbarito et al. (2001). These authors reported significant mental disengagement and a reduction in coping skills at the mid-point of an expedition of nine Argentinian males wintering in Antarctica. Nicolas et al. (2015) also observed mood fluctuations occurring outside the proposed parameters of the third-quarter phenomenon, as distress ratings in winter personnel from France and Italy peaked at the fourth quarter of deployment. These discrepancies in research surrounding mood fluctuations in Antarctic personnel necessitate further research to elucidate which point, if any, during Antarctic deployment poses the greatest detriment to psychological functioning.

Overall Impact of Antarctic Deployment

The disparity in findings surrounding whether mood fluctuations fall within parameters consistent with the third-quarter phenomenon is not the only inconsistency in literature surrounding the impact of Antarctic deployment on psychological functioning. Research findings are also inconsistent surrounding whether Antarctic deployment has an overall negative impact on psychological functioning. Whilst some findings have suggested that psychological health deteriorates across deployment (e.g. Palinkas et al. 1996; Palinkas & Browner, 1996), several studies have failed to observe a detrimental impact of Antarctic deployment on the psychological functioning of personnel. Xu et al. (2003) did not identify any significant differences in mood in 10 Chinese personnel between the beginning and end of the winter deployment period. Likewise, Weiss, Suedfeld, Steel, and Tanaka (2000) failed to find a detrimental change in mood between pre-deployment and post-deployment across three crews, totalling 107 personnel, posted at Japan's Asuka station during winter. This discrepancy in findings brings into question whether Antarctic deployment has a universally detrimental impact on the psychological functioning of Antarctic personnel.

A postulated explanation for this discrepancy in findings surrounding the overall impact of Antarctic deployment on mood is the impact of culture (Bhargava et al., 2000). Culture may be defined as a socially constructed collection of practices, ideas, symbols, values, and goals which differentiates one group of people from another (Hofstede, 1983). From a theoretical perspective, the notion of culture being a moderator on mood in Antarctic personnel holds validity. Within routine environments it has been identified that an individual's culture influences how they appraise and respond to stressors due to mechanisms including previous exposure

(Spradley & Phillips, 1972), acceptable standards of symptom expression (Burke & Feitosa, 2015), and engagement of varying coping mechanisms (Taylor, Welch, Kim, & Sherman, 2007). As previously indicated, the psychological parameters in Antarctica are subjectively influenced by an individual's appraisal of the environment, rather than the physical environment itself (Suedfeld & Weiss, 2000). Therefore, if culture influences how an individual appraises and responds to a situation in a routine environment, it may also influence how an individual appraises and responds whilst in a EUE such as Antarctica. To date only one study has investigated the impact of culture on psychological functioning in Antarctic personnel. Palinkas et al. (2004) investigated psychological functioning in winter-over personnel from a number of different nations including America, China, Russia, Poland, and India. It was observed that fluctuations in mood differed across national culture (Appendix B), thus suggesting culture may be a moderating factor in mood fluctuations in Antarctic personnel. Despite this evidence, no further research has been identified as assessing the impact of culture on mood fluctuations in Antarctic populations.

Limitations of Current Literature

Despite a considerable amount of research investigating whether mood fluctuations are consistent with the third-quarter phenomenon in Antarctic personnel, there continues to be substantial variability in findings. From a methodological perspective, research investigating mood fluctuations in Antarctic personnel can be identified as being heavily influenced by Bechtel and Berning's (1991) proposed third-quarter phenomenon, with researchers analysing and reporting data in quarter averages or only collecting data at the end of each quarter – despite the fact that the quarterly division may be potentially arbitrary. This represents a significant confound as it increases the likelihood of finding quarterly effects by obscuring results, and can lead to significant misinterpretation of the data (Rogelberg, 2008).

A second explanation for the inconsistency in findings surrounding mood fluctuations in Antarctic personnel could be linked to the small sample sizes in studies, which has repeatedly been reported as a methodological limitation in research investigating Antarctic populations (Bhargava et al., 2000; Ikegawa, Kimura, Makita, & Itokawa, 1998; Johnson, Boster, & Palinkas, 2003), particularly during the winter deployment period. During the winter deployment period approximately only 250 personnel are present across the 41 research bases that are considered to have a permanent, year-round, open status (Appendix A). This small population of potential participants is impacted further by research requiring voluntary consent to participate, as on average in research utilising human subjects only 3-20% of the eligible participant population consent to participate in studies (Monette, Sullivan, & DeJong, 2013). Small sample sizes result in studies having low statistical power which negatively impacts the probability that a nominally statistically significant finding reflects a true effect, as the estimated magnitude of the effect in a low power study is likely to be exaggerated, also minimising the probability of finding a true effect if one exists (Button et al., 2013). Therefore, the small sample sizes in Antarctic research investigating psychological functioning can detrimentally impact the validity of the research conclusions. Shea et al. (2011) suggested that the employment of a meta-analytic technique to synthesise existing empirical research would offer a more complete understanding of the data, as the accumulation of data for stand-alone studies in Antarctic research is slow and sparse due to the inherent characteristics of Antarctic deployment (Zimmer et al., 2013). A meta-analysis can be identified as holding utility for the dispersed nature of data collected in Antarctic research because meta-analyses by nature address broader questions than individual studies, and thus can assess and compare the consistency, and hence generalisability, of findings between studies (Borenstein, Hedges, Higgins, & Rothstein, 2009a). To date this has not occurred.

Rationale and Objectives

Given the discrepancy in results, methodological limitations, and confounds of existing research, it is difficult to ascertain the critical phases and universality of mood fluctuations in Antarctic personnel. The identification of any critical phases of mood fluctuations in Antarctic personnel would have significant utility in the development of proactive prevention strategies and targeted interventions to maximise personnel's psychological functioning and work productivity during their deployment in Antarctica (Norris, Paton & Ayton, 2010). Likewise, identifying whether Antarctic deployment has an overall negative impact on the psychological functioning across all Antarctic personnel, or if this impact is moderated via culture, can assist in the alteration of strategies and interventions to take into account cultural differences where necessary (Zimmer et al., 2013). Although a meta-analytic approach has been suggested to hold utility in elucidating the psychological impacts of Antarctic deployment on deployed personnel, to date none has been completed. Therefore, the present study aimed to systematically review existing literature investigating mood fluctuations in Antarctic personnel and utilise meta-analytic techniques to attempt to answer the following research questions:

- Are mood fluctuations in Antarctic personnel consistent with the proposed parameters of the 'third-quarter phenomenon' when available data are analysed in monthly intervals?

- Once the methodological limitation of small sample sizes is removed, can an overall negative impact on psychological functioning in Antarctic personnel be universally identified?
- Is culture a moderating factor on mood fluctuations in Antarctic personnel?

Method

To answer the proposed research questions, a systematic meta-analytic review was conducted. Results were reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Statement (Moher, Liberati, Tetzlaff, & Altman, 2009) (Appendix C).

Information Sources and Literature Search

Search strategy.

Four electronic databases – *Scopus, Web of Science, PubMed,* and *ProQuest* were searched using the following search strings, selected on the basis of theoretical relevance: (1) 'cold climate' or 'Antarctic regions' or 'isolated, confined environment (ICE)' or 'extreme environment'; and (2) 'adverse effects' or 'human' or 'social isolation' or 'seasonal variation' or 'behavioural change' or 'adaptation' or 'interpersonal relations' or 'time factors' or 'stress reactions' or 'mood'; and (3) 'polar work' or 'research personnel' or 'expedition' or 'polar psychology' or 'psychology'; and (4) 'third-quarter phenomenon' or 'winter-over syndrome' or 'winter-over' or 'toast' or 'long-eye' or 'hundred-foot stare' or 'big eye' or 'Antarctic stare'.

Eligibility criteria.

Studies were eligible for inclusion in the present review if they met the following inclusion criteria: (a) participants were Antarctic personnel; (b) assessment of negative mood was recorded; (c) data consisted of a numerical finding, including descriptive or inferential statistics.

Studies were excluded if they were: (a) focused on populations outside of Antarctica (i.e., Artic and subpolar regions); (b) published as popular media; (c) studies with secondary analysis of data already identified in other included studies, or (d) if reviews recorded and reported an insufficient amount of data points to allow comparison (fewer than two).

A random selection of studies was double coded by the student investigator and supervisor to assess the quality of studies included that met the explicit criteria, with high inter-rater agreements found (Cohen's *k* =1.00).

A flow chart depicting the study selection process is shown in Figure 1.

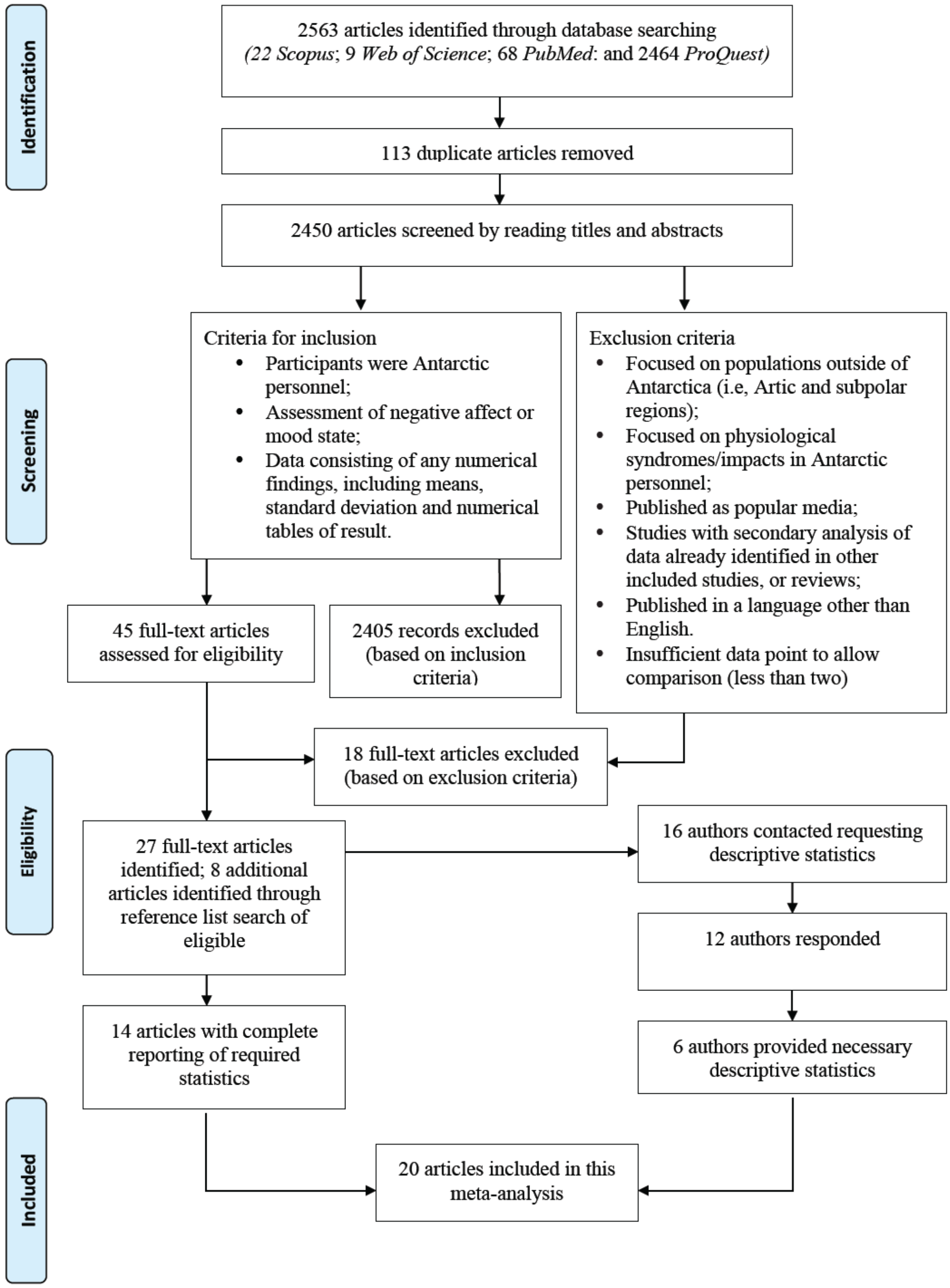


Figure 1. Flow diagram for literature search and study selection process.

Meta-Analytic Strategy

All analyses were conducted using *Comprehensive Meta-Analysis Version 2.2* (Borenstein, Hedges, Higgins, & Rothstein, 2010*).* This statistical software was selected due to its versatility in conducting a range of complex meta-analytic techniques and capability to compute an effect size from a range of descriptive and inferential statistical information (Bax, Yu, Ikeda, & Moons, 2007). Where possible, descriptive statistical data were utilised, however inferential data were utilised when descriptive statistics were not available, as indicated in Tables 1, 2, 3, and 4.

Selected Effect Size

As previously indicated, there is no standardised measurement scale to assess the psychological impact of Antarctic deployment. Because of this, studies identified as meeting the inclusion criteria for this meta-analysis utilised a variety of scales, as indicated in Tables 1, 2, 3, and 4. Due to the use of different measurement scales across studies, Cohen's *d* was calculated as a standardised unit of effect size with 95% confidence intervals (CI). As all studies included in the meta-analysis used matched groups (within-subjects design), a matched Cohen's *d* formula was utilised, where M_1 and M_2 represent the means at each time-point (i.e., baseline time-point and post deployment time-point), S_{within} is the standard deviation of the difference, and r is the correlation between the observations (e.g., the pre-post correlation) (Borenstein, Hedges, Higgins, & Rothstein, 2009a)

$$\text{Cohen's } d = \frac{M_{diff}}{S_{within}} = \frac{M_1 - M_2}{S_{within}}$$

$$S_{within} = \frac{S_{diff}}{\sqrt{2(1-r)}}$$

As studies which reported descriptive statistics included in the current analysis did not report the pre-post correlation, a pre-post correlation of $r = .50$ for all studies was assumed, after conducting a sensitivity analysis using the following plausible correlation ranges: $r = 0.25$, $r = 0.50$ and $r = 0.75$ (Appendix D, Appendix E and Appendix F). The sensitivity analysis revealed an inconsequential change between the pre-post correlation values, as indicated by less than 20% difference between effect size estimates, which has been used in other matched groups meta-analyses (Del Re, Maisel, Blodgett, Wilbourne, & Finney, 2013; Paul, Siegel, Malley, & Jaeger, 2007; Stedman, Curtin, Elbourne, Kesselheim, & Brookhart, 2011; Trask, Walsh, & DiLillo, 2011; Young et al., 2015).

Interpretation guidelines for Cohen's *d* state an effect size of 0.20 is small, 0.50 is medium, and 0.80 is large (Cohen, 1988). Whilst it has been acknowledged that Cohen's (1988) interpretation guideline values are arbitrary and should not be rigidly interpreted (Thompson, 2007), these benchmark values do hold utility in novel research, where comparisons to other related findings in literature is not possible (Cohen, 1988; Lakens, 2013). As the current meta-analysis can be identified as novel, and only one study included in the analysis reported a measurement of effect size, Cohen's interpretation guidelines were utilised.

Due to the inherent methodological limitations of small populations in Antarctic research, a majority of the studies meeting the inclusion criteria had small sample sizes. The inclusion of studies with small sample sizes can result in lower methodological quality of the meta-analytic outcomes, with some researchers arguing that only studies with large sample sizes should be included in a meta-analysis (Greco, Zangrillo, Biondi-Zoccai, & Landoni, 2013). However, this recommendation is not possible in this area of research (which is characterised by small sample sizes), as only a select few studies would be able to be used, resulting in a loss of information. To reduce the impact of the small sample sizes of included studies, sample size weighted effects sizes were calculated to reduce any potential bias in the outcomes. This results in effect sizes being weighted by the inverse of the within-subjects variance and the between-subjects variance (tau-square) (Borenstein et al., 2010). Therefore, more weight is assigned to studies that have large sample sizes, thus carrying more information and can be considered as a more optimal estimator of effect.

For studies that reported results for multiple constructs or subscales measuring negative mood (e.g., depression, hostility, and anxiety) in the same group of participants, a composite effect size for the study was computed (Appendix G, Appendix H and Appendix J), using the following formula where *m* equals the number of outcomes in the study, *r* equals the pre-post correlation between means, and *j* equals the time-point in the study (Borenstein, Hedges, Higgins & Rothstein, 2009c), written as:

$$Y = \frac{1}{m}\left(\sum_{\mathrm{j}}^{m} Y_j\right)$$

$$V_Y = \left(\frac{1}{m}\right)^2 \mathrm{Var}\left(\sum_{j=1} Y_i\right) = \left(\frac{1}{m}\right)^2 \left(\sum_{j=1} V_i + \sum_{j \neq \mathrm{k}} \left(r_{jk} \sqrt{Vj}\sqrt{Vk}\right)\right)$$

Meta-Analytic Model

Each analysis was conducted using a random effects statistical model. In this model y_i is an effect size in the *i*th study, β_0 is the average population effect, u_i is the study level random effect, and e_i is the study level residual (Borenstein et al., 2010), written as:

$$y_i = \beta_0 + u_i + e_i$$

A random effects statistical model allows the true effect size to differ between the studies included in the analysis, as this model assumes that the variability between sampling size is due to sampling error plus the variability in the population of effects, as each study is estimating from a slightly different population (Borenstein et al., 2010). This model can be argued to hold greater utility over the fixed effects model (which assumes that there is one true effect size underlying all the studies in the analysis) because it can account for the heterogeneity of effect sizes between studies by estimating the inter-study variance. This variance is then included in the model to provide an estimate of the mean of the distribution of the true effects (Borenstein et al., 2010).

Assessment of Heterogeneity

The Q statistic, in combination with the I^2 statistic, was utilised to identify and assess the heterogeneity in effect sizes. A Q statistic is a measure of weighted squared deviations, which provides the ratio of observed variation to the within-study error. A significant p value indicates heterogeneity between the individual studies (Rothstein, Sutton, & Borenstein, 2006). An I^2 statistic specifies the percentage of the between-study variability in the effect sizes due to differences between the studies included in the analysis rather than random error. An I^2 result of 25% is considered to indicate low heterogeneity, 50% indicates moderate heterogeneity, and 75% or above indicates high heterogeneity (Higgins & Thompson, 2002).

Units of Analysis and Data Sets

Following a review of studies that met the inclusion criteria, several common data collection and reporting methods across studies were identified: monthly, quarterly, baseline and conclusion of both summer and winter deployments. Based on this classification, four separate meta-analyses were run. This was required to allow clearer inferences to be made surrounding the research questions, but also because the differences in data collection methods were not directly comparable and would result in a loss of information.

To investigate research question one, studies that assessed mood monthly were analysed using a repeated-measures all time-points meta-analysis, where Y_{it} is the summary estimate for every study (i) and time-point (t), and θ_{it} represents the variance (Borenstein et al., 2009c), written as:

$$Y_{it} \sim N(\theta\ \mathrm{it},\ \sigma\ \mathrm{i2t})\ \ \mu\ \sim [-,-]$$

$$\theta_{it} \sim N(\mu\ \mathrm{t},\ \tau\ \mathrm{t2})\ \ \tau\ \sim [-,-]$$

Repeated-measures methodologies take into account information reflected over time, and can assess trends within responses, which conventional meta-analysis methodologies do not allow (Peters & Mengersen, 2008). However, when conducting repeated-measures analyses, the temporal non-independence between measures must be taken into consideration, as individuals contribute data to the pooled estimate at more than one time-point (Borenstein, et al., 2009c). Ignoring the temporal non-independence between pooled estimates can lead to an overestimation of variance within the analysis, which impacts the precision of estimated effects (Peters & Mengersen, 2008). To account for the non-temporal independence within the analysis a pre-post correlation between effects reported in studies must be included within the analysis. As studies do not commonly report pre-post correlations, a pre-post correlation of r = .50 for all studies was assumed, after conducting a sensitivity analysis using the following plausible correlation ranges: r = 0.25, r = 0.50, and r =0.75 (Appendix D and Appendix E).

Unfortunately, comprehensive meta-analysis software does not currently have the capability to set the pre-post correlation value in a repeated-measures all time-points meta-analysis, thus the analyses can be set to having a correlation value of 1.00

(resulting in a decrease in variance), or 0.00 (resulting in an increase in variance, as the time-points are treated as independent). This can result in an incorrect estimate being produced. To overcome this limitation of the software, a synthetic effect size was calculated prior to being entered into the software, as recommended by Borenstein et al. (2010). In the synthetic effect size formula M and V represent the descriptive statistics, mean and variance respectively, at each time-point, and *r* is the correlation between the observations, written as:

$$Y_{\mathrm{diff}} = M1 - M2 ;$$

$$VM_{diff} = VM_1 + VM_2 - 2r \sqrt{} VM_1 \sqrt{} VM_2$$

This approach addresses the limitation of choosing either a 1.00 or 0.00 pre-post correlation value, as the formula for the variance of the synthetic effect allows a more realistic pre-post correlation value to be set (Borenstein et al., 2009c).

Due to the variety of analysis comparisons utilised in studies included in the analyses, two separate repeated-measures all time-points meta-analyses were conducted. The first analysis (Analysis One) compared the monthly measures of negative mood to a baseline measure, operationalised as the first month of the winter deployment period. The second analysis (Analysis Two) progressively compared monthly measures of negative mood to the month prior, in the winter deployment period.

Two separate analyses were also conducted to assess research questions two and three for data collected over the summer deployment period and winter deployment period, respectively. Separate analyses for summer (Analysis Three) and winter deployment (Analysis Four) were necessary due to the contrasting characteristics of these respective deployment seasons, such as deployment length (3-5 months during the summer deployment season, in contrast to 8-10 months during the winter deployment season), population size on the research bases (see Appendix A), and differences in environmental characteristics including weather conditions, temperature, and light/day cycles (AAD, 2015). As Analyses Three and Four only assessed two time-points (a baseline and an end of deployment measure of negative mood), standard meta-analytic methods were utilised to produce a single summary effect (Peters & Mengersen, 2008). Allocation of studies to the respective analysis based on data collection and reporting methods is outlined in Tables 1, 2, 3, and 4.

Several of the included studies were identified as having data collected over subsequent deployment years and/or research bases. Where possible, data collected in separate years, or across separate research bases, were analysed separately. This is because the group dynamics including crew tension and cohesion, as well as leadership dynamics on a research base have been identified as being one of the greatest sources of stress in Antarctica (Stuster, Bachelard, & Suedfeld, 2000). Therefore, analysing data separately by research base and deployment year, where possible, minimises a potential loss of information.

Moderation Analyses

The study moderator of culture was operationalised based on nationality. Nationality is one of the most common ways to differentiate individuals into cultural groups (Sutton & Pierce, 2003). One of the most widely used theoretical approaches in research to compare national cultures has focused on two constructs: individualism and collectivism (Clark, Eckhardt, & Hofstede, 2003). Allocation to these constructs relates to how individuals define themselves and their relationships with others (Brewer & Chen, 2007). A national culture that has a strong focus on self-definition based on autonomy and separation from others is deemed an individualistic culture (e.g. Australia), whilst a national culture that has a strong focus on interdependence and social embeddedness is deemed a collectivist culture (e.g., Japan) (Triandis, 1995). Allocation of included studies to either an individualistic or collectivist culture was based on Hofstede (1983) individualism (IDV) index (Appendix J). A score of 50 or above on the IDV index resulted in the nationality of the research sample being categorised as an individualistic culture, whilst a score of 49 or below resulted in the nationality of the research sample being categorised as a collectivist culture. This categorical moderator variable was assessed by a *Q*-test based on analysis of variance (Borenstein, Hedges, Higgins, & Rothstein, 2009b).

Assessment of Publication Bias

When conducting a meta-analysis, key validity threats in regard to the outcome must be acknowledged (Sharpe, 1997). It is possible the results will be biased, due to unpublished, missing, or unidentified studies that potentially report non-significant or contradictory findings. To address potential publication bias, the Trim and Fill method by Duval and Tweedie (2000) was utilised, as it is a recommended and widely used index to investigate publication bias in meta-analyses (Ferguson & Brannick, 2012). The Trim and Fill method plots the sample size and effect size of studies included in the analysis to assess potential publication bias. In the absence of publication bias, symmetry between the sample size and effect size is expected. In the case of asymmetry, the Trim and Fill method imputes effect sizes, which are included in the revised overall effect to correct for publication bias (Ferguson & Brannick, 2012). However, a key assumption of the Trim and Fill method is that the observed asymmetry is due to publication bias, rather than a 'small-study effect'. If this assumption is violated then the idea of imputing missing studies cannot be supported (Rothstein et al., 2006). As a number of the studies included in the current analysis had small sample sizes, it is possible this assumption was violated. To investigate this, a subsequent cumulative meta-analysis was conducted. When used as a measure of publication bias, cumulative meta-analysis sorts studies included into the analysis from low to high standard error, as low standard error studies are those with the largest sample size, resulting in greater precision (McDaniel, 2009). Once the effect sizes are sorted according to study precision, an iterative meta-analysis is conducted. This adds one additional effect size in each iteration, with effects entered first holding greater precision, in comparison to those added later. The cumulative means are then plotted for evidence of drift. If small sample sizes with small effects are being suppressed, the cumulative means will show a drift in a positive direction as studies with small sample sizes are added to the analysis (McDaniel, 2009), thus suggesting that studies with less precision have larger effect sizes than studies with greater precision, indicating a publication bias.

As comprehensive meta-analysis software does not have the capability to investigate publication biases on all time-points in repeated-measures all time-points meta-analysis, publication bias was investigated at the first time-point in each analysis (March-April), as a baseline indication, and also at the third-quarter deployment time-points (March-August and March-September in Analysis One, and August-September in Analysis Two) as these are the key points of interest for research question one.

Results

Are mood fluctuations in Antarctic personnel consistent with the proposed parameters of the 'third-quarter phenomenon' when available data are analysed in monthly intervals?

Analysis One

Analysis One investigated research question one using a repeated time-point meta-analysis, which compared monthly measurements of negative mood to a baseline, operationalised as the first month of deployment during the winter-over period (March). Characteristics of studies included in Analysis One are listed in Table 1. Compared to March, negative mood was higher during May, July, August, September and October. Compared to March, negative mood was lower in April and June. No significant difference between March and any other month during the Austral winter was identified, with all effects sizes trivial, except for March-July and March-October, where a small effect size was identified (Figure 2).

Assessment of heterogeneity.

All included studies were identified as being moderately to highly heterogeneous, with a significant dispersion between studies, indicating there was substantial variability in the effect sizes between studies included. However, for the March-June comparison, a low heterogeneity and non-significant dispersion was identified, indicating that the variability in effect sizes between studies at this time-point was minimal (Table 5).

Assessment of publication bias.

Funnel plots for the March-April, March-August, and March-September analyses are shown in Figures 3, 4, and 5, respectively. For the March-April analysis, under the random effects model, the point estimate and 95% CI for the combined studies was 0.16 [-0.21, 0.30]. Using Trim and Fill two studies were imputed, resulting in an adjusted point estimate of 0.23 [-0.04, 0.50]. For the March-August analysis, under the random effects model the point estimate and 95% CI for the combined studies was -0.18 [-0.42, 0.06]. Using Trim and Fill two studies were imputed, resulting in an adjusted point estimate of 0.01 [-0.26, 0.28]. For the March-September analysis, under the random effects model the point estimate and 95% CI for the combined studies was 0.05 [-0.50, 0.17]. Using Trim and Fill two studies were imputed, resulting in an adjusted point estimate of 0.13 [-0.21, 0.25]. Cumulative meta-analyses were also conducted for the March-April, March-August and March-September analyses, shown in Figures 6, 7, and 8, respectively. No positive drift in effect sizes was identified, thus indicating no small sample size effects.

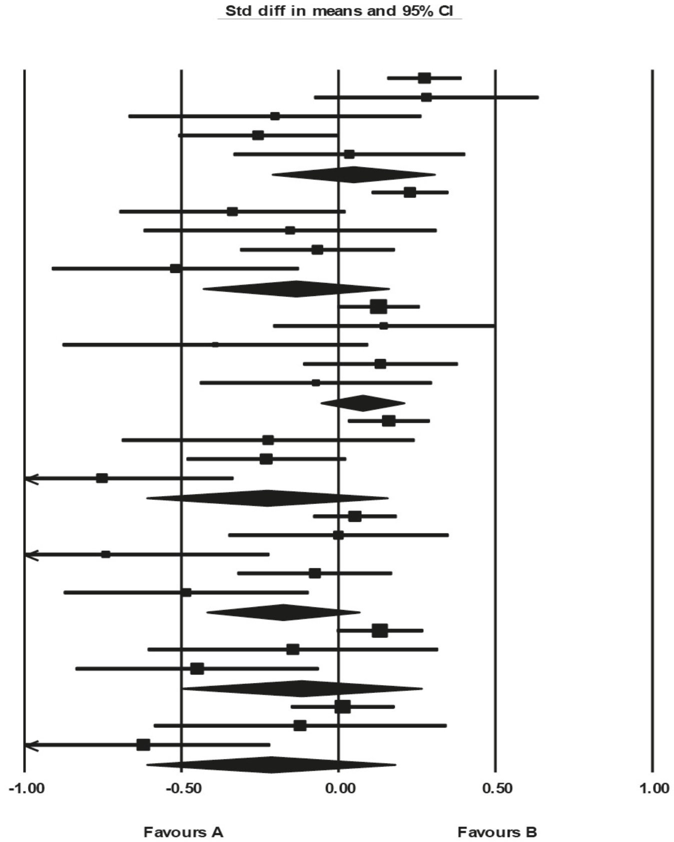
Table 1
Studies Included in Analysis One

Author	YoP	YoD	SS	G	DS	RB	N	CO	SP	NMS	ToP	SMA
Norris	2010		338	72% Male	Winter-Over		Australian	I		Hopkins Symptom Checklist (21 item version): General Distress subscale	PhD Thesis	Descriptive Statistics
Oliver	1991	1977	31		Winter-Over	McMurdo Station	American	I	Military/ Scientific Discipline /Logistical Support	Winter Over Status Questionnaire	PhD Thesis	Descriptive Statistics
Palinkas et al.,	2000b	1991	18	78% Male	Winter-Over	South Pole Station	American	I	Military/ Scientific Discipline /Logistical Support	Composite Score of the Total Mood Disturbance Scale from the Profile of Mood States Scale	Journal Article	Descriptive Statistics
Palinkas et al.,	2000a	1991	62	76% Male	Winter-Over	McMurdo Station	American	I	Military/ Scientific Discipline /Logistical Support	Composite Score of the Total Mood Disturbance Scale from the	Journal Article	Descriptive Statistics

Weiss et al.,	2004		32	100% Male	Winter-Over	Dumont-d'Urville	French	I	Scientific Discipline / Logistical Support	Profile of Mood States Scale Negative Polarity of Journal Entries	Journal Article	Descriptive Statistics

Note. YoP = Year of Publication; YoD = Year of Data Collection; SS = Sample Size; G = Gender; DS = Deployment Season; RB = Research Base; N = Nationality; CO = Cultural Orientation, I = Individualistic; SP = Sample Population; NMS = Negative Mood Scale; ToP = Type of Publication; SMA = Statistics use in Meta-analysis.

Group by Time point	Study name	Std diff in means	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value	Relative weight
		Statistics for each study							
March-April	Norris, 2010	0.27	0.06	0.00	0.15	0.39	4.49	0.00	26.78
March-April	Oliver, 1991	0.28	0.18	0.03	-0.08	0.64	1.53	0.13	18.35
March-April	Palinkas et al., 2000a	-0.20	0.24	0.06	-0.67	0.27	-0.85	0.40	14.70
March-April	Palinkas et al., 2000b	-0.26	0.13	0.02	-0.51	-0.00	-1.96	0.05	22.23
March-April	Weiss et al., 2004	0.03	0.19	0.04	-0.34	0.41	0.18	0.85	17.93
March-April		**0.04**	**0.13**	**0.02**	**-0.21**	**0.30**	**0.34**	**0.74**	
March-May	Norris, 2010	0.23	0.06	0.00	0.10	0.35	3.62	0.00	25.19
March-May	Oliver, 1991	-0.34	0.18	0.03	-0.70	0.02	-1.83	0.07	18.86
March-May	Palinkas et al., 2000a	-0.15	0.24	0.06	-0.62	0.31	-0.65	0.52	15.84
March-May	Palinkas et al., 2000b	-0.07	0.13	0.02	-0.31	0.18	-0.53	0.60	22.21
March-May	Weiss et al., 2004	-0.52	0.20	0.04	-0.91	-0.12	-2.58	0.01	17.90
March-May		**-0.14**	**0.15**	**0.02**	**-0.43**	**0.16**	**-0.92**	**0.36**	
March-June	Norris, 2010	0.13	0.07	0.00	-0.00	0.26	1.91	0.06	48.16
March-June	Oliver, 1991	0.14	0.18	0.03	-0.21	0.50	0.80	0.42	12.13
March-June	Palinkas et al., 2000a	-0.39	0.25	0.06	-0.88	0.10	-1.57	0.12	6.80
March-June	Palinkas et al., 2000b	0.13	0.13	0.02	-0.11	0.38	1.06	0.29	21.74
March-June	Weiss et al., 2004	-0.07	0.19	0.04	-0.44	0.30	-0.38	0.70	11.17
March-June		**0.07**	**0.07**	**0.00**	**-0.06**	**0.21**	**1.09**	**0.27**	
March-July	Norris, 2010	0.16	0.07	0.00	0.03	0.29	2.39	0.02	29.58
March-July	Palinkas et al., 2000a	-0.22	0.24	0.06	-0.69	0.24	-0.94	0.35	21.03
March-July	Palinkas et al., 2000b	-0.23	0.13	0.02	-0.49	0.03	-1.76	0.08	26.97
March-July	Weiss et al., 2004	-0.75	0.21	0.05	-1.17	-0.33	-3.52	0.00	22.41
March-July		**-0.23**	**0.20**	**0.04**	**-0.61**	**0.15**	**-1.18**	**0.24**	
March-August	Norris, 2010	0.05	0.07	0.00	-0.08	0.19	0.76	0.44	28.18
March-August	Oliver, 1991	0.00	0.18	0.03	-0.35	0.35	0.00	1.00	18.70
March-August	Palinkas et al., 2000a	-0.74	0.27	0.07	-1.26	-0.22	-2.78	0.01	12.69
March-August	Palinkas et al., 2000b	-0.08	0.13	0.02	-0.32	0.17	-0.59	0.55	23.33
March-August	Weiss et al., 2004	-0.48	0.20	0.04	-0.88	-0.09	-2.43	0.02	17.10
March-August		**-0.18**	**0.12**	**0.02**	**-0.42**	**0.06**	**-1.45**	**0.15**	
March-September	Norris, 2010	0.13	0.07	0.01	-0.01	0.27	1.86	0.06	42.30
March-September	Palinkas et al., 2000a	-0.15	0.24	0.06	-0.61	0.32	-0.61	0.54	27.04
March-September	Weiss et al., 2004	-0.45	0.20	0.04	-0.84	-0.06	-2.27	0.02	30.66
March-September		**-0.12**	**0.20**	**0.04**	**-0.50**	**0.26**	**-0.62**	**0.53**	
March-October	Norris, 2010	0.01	0.08	0.01	-0.15	0.18	0.16	0.87	41.76
March-October	Palinkas et al., 2000a	-0.12	0.24	0.06	-0.59	0.35	-0.51	0.61	27.62
March-October	Weiss et al., 2004	-0.62	0.21	0.04	-1.03	-0.22	-3.01	0.00	30.62
March-October		**-0.22**	**0.20**	**0.04**	**-0.61**	**0.18**	**-1.08**	**0.28**	



Meta Analysis

Figure 2. Forest Plot of studies included in Analysis One.

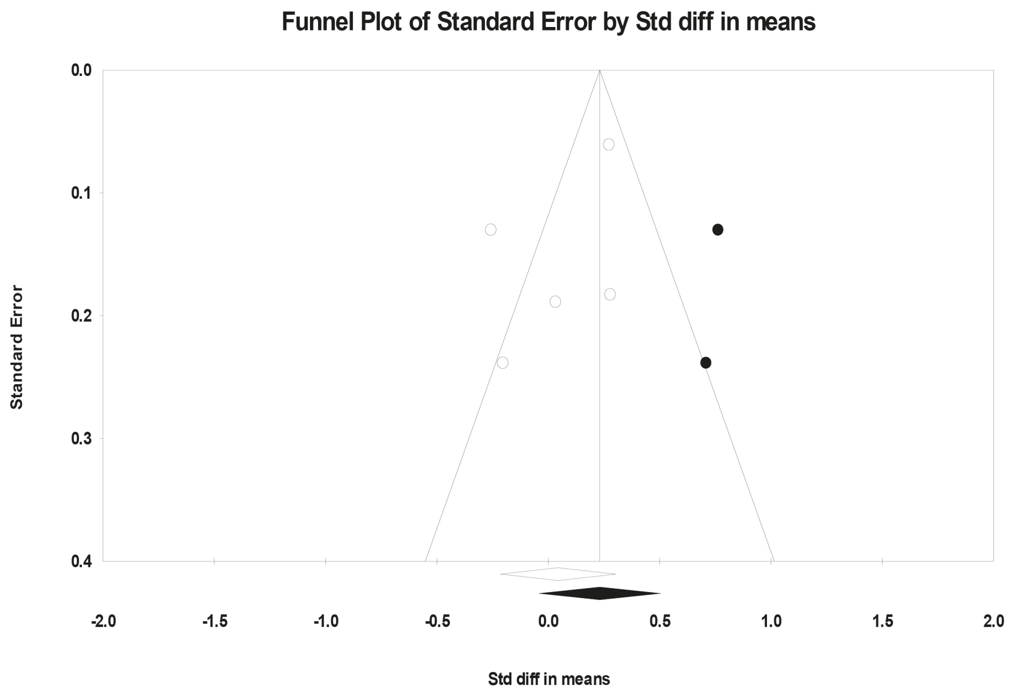


Figure 3. Funnel plot for studies included in Analysis One at time-point March-April.

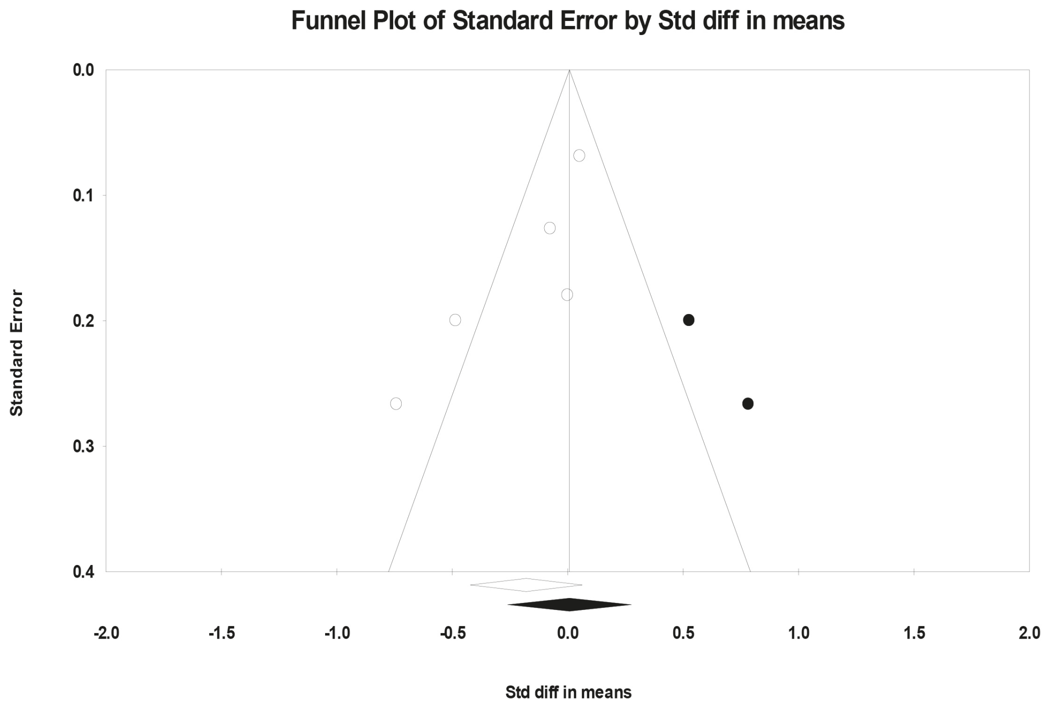


Figure 4. Funnel plot for studies included in Analysis One at time-point March-August.

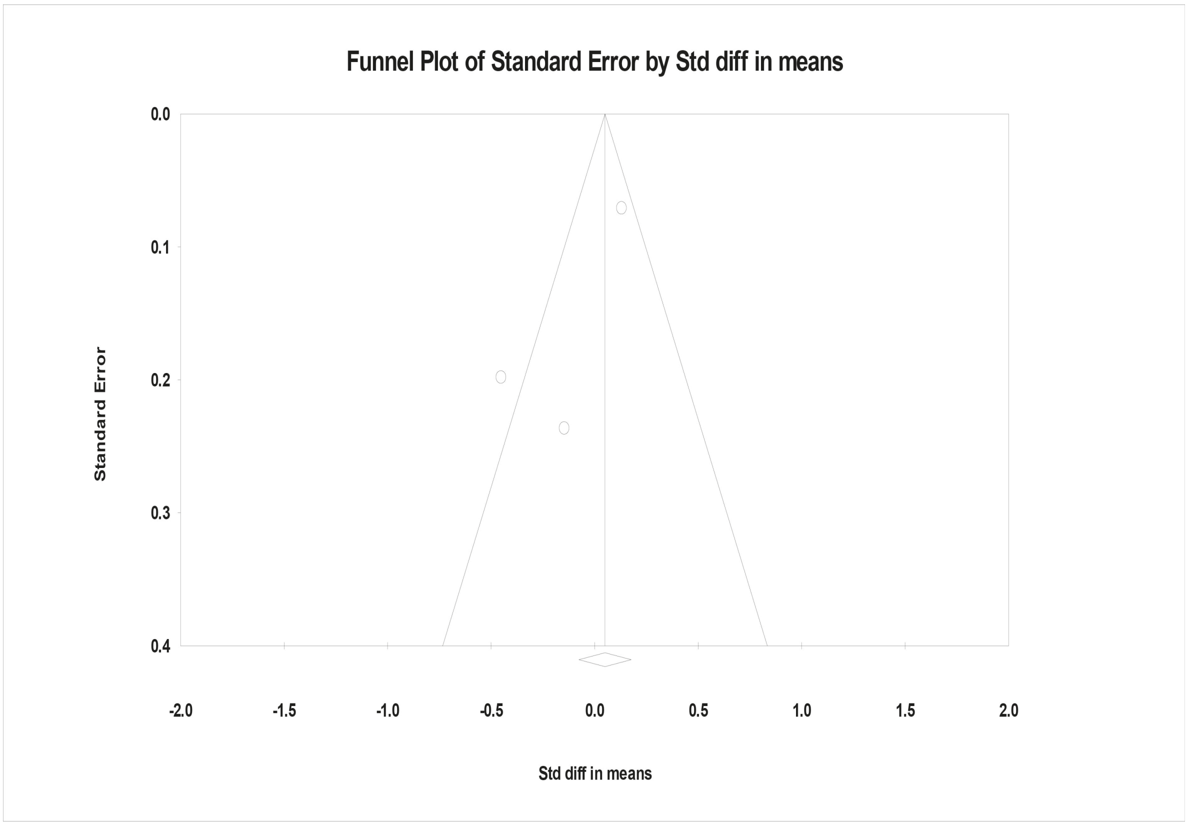
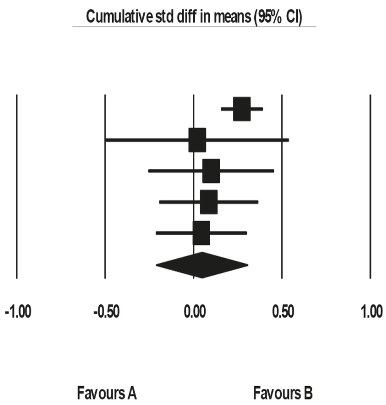


Figure 5. Funnel plot for studies included in Analysis One at time-point March-September.

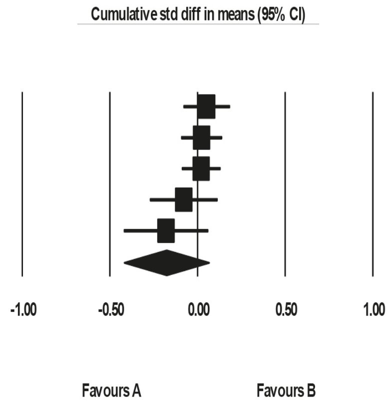
Study name	Time point	Cumulative statistics							Relative weight
		Point	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value	
Norris, 2010	March-April	0.27	0.06	0.00	0.15	0.39	4.49	0.00	26.78
Palinkas et al., 2000b	March-April	0.02	0.26	0.07	-0.50	0.54	0.08	0.94	49.02
Oliver, 1991	March-April	0.10	0.18	0.03	-0.26	0.46	0.55	0.58	67.37
Weiss et al., 2004	March-April	0.09	0.14	0.02	-0.19	0.37	0.60	0.55	85.30
Palinkas et al., 2000a	March-April	0.04	0.13	0.02	-0.21	0.30	0.34	0.74	100.00
		0.04	**0.13**	**0.02**	**-0.21**	**0.30**	**0.34**	**0.74**	



Meta Analysis

Figure 6. Cumulative meta-analysis for Analysis One at time-point March-April.

Study name	Time point	Point	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value	Relative weight
		Cumulative statistics							
Norris, 2010	March-August	0.05	0.07	0.00	-0.08	0.19	0.76	0.44	28.18
Palinkas et al., 2000b	March-August	0.02	0.06	0.00	-0.09	0.14	0.39	0.70	51.51
Oliver, 1991	March-August	0.02	0.06	0.00	-0.09	0.13	0.37	0.71	70.21
Weiss et al., 2004	March-August	-0.08	0.10	0.01	-0.27	0.12	-0.79	0.43	87.31
Palinkas et al., 2000a	March-August	-0.18	0.12	0.02	-0.42	0.06	-1.45	0.15	100.00
		-0.18	**0.12**	**0.02**	**-0.42**	**0.06**	**-1.45**	**0.15**	



Meta Analysis

Figure 7. Cumulative meta-analysis for Analysis One at time-point March-August.

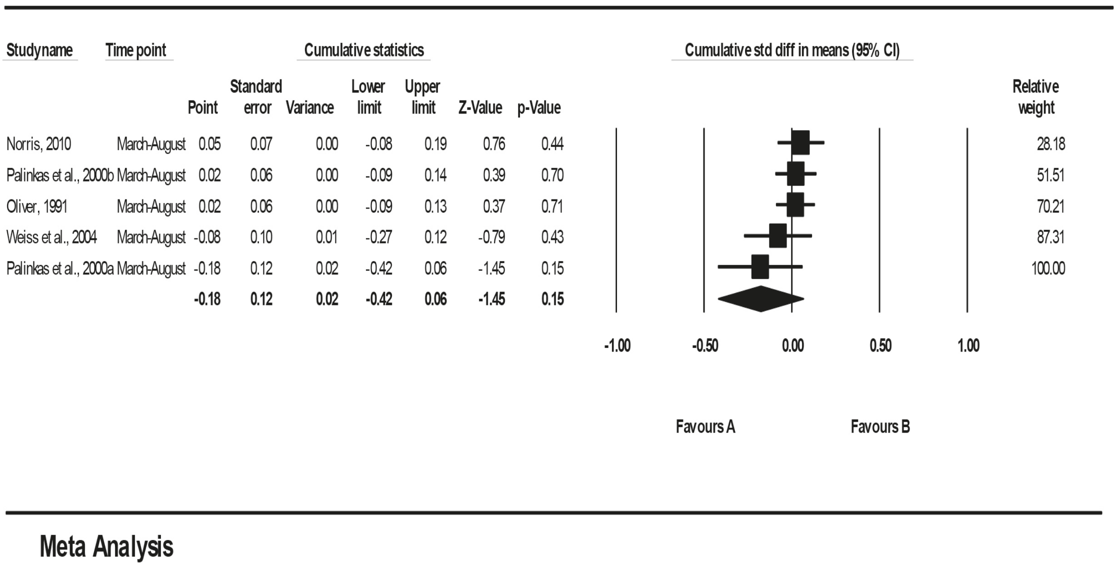


Figure 8. Cumulative meta-analysis for Analysis One at time-point at March-September.

Analysis Two

Analysis Two investigated research question one using a repeated time-point meta-analysis, which progressively compared monthly measurements of negative mood to the preceding month, starting with the first month of the winter-over period (March). Characteristics of studies included in this analysis are listed in Table 2. As indicated in Figure 9, negative mood was higher in the earlier month between March-April, May-June and August-September, whilst negative mood was higher in the latter month between April-May, June-July, July-August and September-October. No significant difference progressively across months during the Austral winter was identified and all effect sizes were trivial.

Assessment of heterogeneity.

Heterogeneity statistics are displayed in Table 5. The progressive monthly comparisons from March to July were identified as being moderately to highly heterogeneous, with a significant dispersion among studies, indicating there was substantial variability in the effect sizes between studies included. However, the progressive monthly comparisons from July to October were found to have low heterogeneity and a non-significant dispersion in studies, indicating that the variability of effect sizes between studies at these time-points was minimal.

Assessment of publication bias.

A funnel plot for the March-April and August-September analysis is shown in Figures 10 and 11, respectively. For the March-April analysis, under the random effects model, the point estimate and 95% CI for the combined studies was 0.044 [-0.21, 0.30]. Using Trim and Fill two studies were imputed, resulting in an adjusted point estimate of 0.23 [-0.04, 0.51]. For the August-September analysis, under the random effects model the point estimate and 95% CI for the combined studies was

0.10 [-0.03, 0.23]. Using Trim and Fill one study was imputed, resulting in an adjusted point estimate is 0.10 [-0.02, 0.23]. Cumulative meta-analyses were also conducted for the March-April and August-September analyses shown in Figures 12 and 13, respectively. No positive drift in effect sizes was identified, thus indicating no small sample size effect.

Table 2
Studies included in Analysis Two

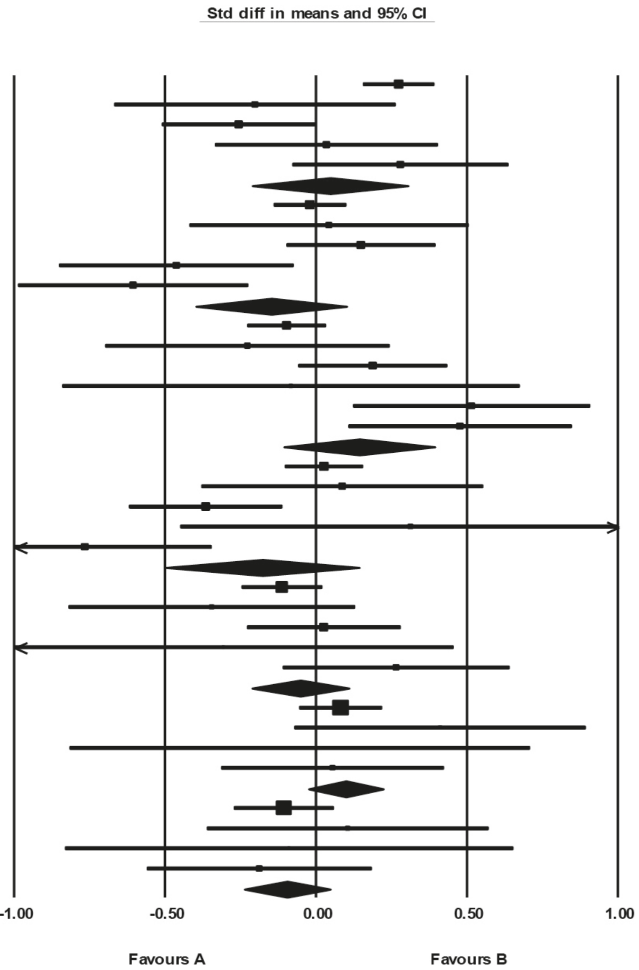
Author	YoP	YoD	SS	G	DS	RB	N	CO	SP	NMS	ToP	SMA
Norris	2010	2005-2009	338	72%	Winter-Over	Casey, Davis, Mawson	Australian	I	Scientific Discipline/Logistical Support	Hopkins Symptom Checklist (21item version): General Distress subscale	PhD Thesis	Descriptive Statistics
Oliver	1991	1977	31		Winter-Over	McMurdo Station	American	I	Military/ Scientific Discipline/Logistical Support	Winter Over Status Questionnaire	PhD Thesis	Descriptive Statistics
Palinkas et al.,	2000a	1991	18		Winter-Over	South Pole Station	American	I	Military/ Scientific Discipline/Logistical Support	Composite Score of the Total Mood Disturbance Scale from the Profile of Mood States Scale	Journal Article	Descriptive Statistics

				78%								
Palinkas et al.,	2000		62	76%	Winter-Over	McMurdo Station	American	I	Military/ Scientific Discipline/Logistical Support	Composite Score of the Total Mood Disturbance Scale from the Profile of Mood States Scale	Journal Article	Descriptive Statistics
Palinkas et al.,	2000c		8		Winter-Over	Palmer Station	American	I	Military/ Scientific Discipline/Logistical Support	Composite Score of the Total Mood Disturbance Scale from the Profile of Mood States Scale	Journal Article	Descriptive Statistics
Weiss et al.,	2004		32	100 %	Winter-Over	Dumont-d'Urville	French	I	Scientific Discipline/ Logistical Support	Negative Polarity Journal Entries	Journal Article	Descriptive Statistics

Note. YoP = Year of Publication; YoD = Year of Data Collection; SS = Sample Size; G = Gender; DS = Deployment Season; RB = Research Base; N = Nationality; CO = Cultural Orientation, I = Individualistic; SP = Sample Population; NMS = Negative Mood Scale; ToP = Type of Publication; SMA = Statistics use in Meta-analysis.

Group by Time point	Study name	Std diff in means	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value	Relative weight
March-April	Norris et al., 2010	0.27	0.06	0.00	0.15	0.39	4.49	0.00	26.79
March-April	Palinkas et al., 2000a	-0.20	0.24	0.06	-0.67	0.27	-0.85	0.40	14.70
March-April	Palinkas et al., 2000b	-0.26	0.13	0.02	-0.51	-0.00	-1.96	0.05	22.23
March-April	Weiss et al., 2004	0.03	0.19	0.04	-0.34	0.41	0.18	0.85	17.93
March-April	Oliver, 1991	**0.28**	**0.18**	**0.03**	**-0.08**	**0.64**	**1.53**	**0.13**	18.35
March-April		0.04	0.13	0.02	-0.21	0.30	0.34	0.74	
April-May	Norris et al., 2010	-0.02	0.06	0.00	-0.14	0.10	-0.32	0.75	27.70
April-May	Palinkas et al., 2000a	0.04	0.24	0.06	-0.42	0.51	0.18	0.86	14.66
April-May	Palinkas et al., 2000b	0.15	0.13	0.02	-0.10	0.40	1.18	0.24	22.95
April-May	Weiss et al., 2004	-0.46	0.20	0.04	-0.85	-0.07	-2.33	0.02	17.22
April-May	Oliver, 1991	-0.61	0.20	0.04	-0.99	-0.22	-3.10	0.00	17.47
April-May		**-0.15**	**0.13**	**0.02**	**-0.40**	**0.10**	**-1.18**	**0.24**	
May-June	Norris et al., 2010	-0.10	0.07	0.00	-0.23	0.03	-1.45	0.15	24.78
May-June	Palinkas et al., 2000a	-0.23	0.24	0.06	-0.70	0.25	-0.94	0.35	13.66
May-June	Palinkas et al., 2000b	0.19	0.13	0.02	-0.06	0.44	1.49	0.14	21.09
May-June	Palinkas et al., 2000c	-0.08	0.39	0.15	-0.84	0.68	-0.21	0.83	7.71
May-June	Weiss et al., 2004	0.52	0.20	0.04	0.12	0.91	2.56	0.01	16.01
May-June	Oliver, 1991	0.48	0.19	0.04	0.11	0.85	2.52	0.01	16.76
May-June		**0.14**	**0.13**	**0.02**	**-0.11**	**0.39**	**1.10**	**0.27**	
June-July	Norris et al., 2010	0.03	0.07	0.00	-0.10	0.16	0.39	0.69	27.59
June-July	Palinkas et al., 2000a	0.09	0.24	0.06	-0.38	0.55	0.36	0.72	17.85
June-July	Palinkas et al., 2000b	-0.37	0.13	0.02	-0.62	-0.11	-2.80	0.01	24.41
June-July	Palinkas et al., 2000c	0.31	0.39	0.15	-0.45	1.08	0.80	0.42	10.90
June-July	Weiss et al., 2004	-0.77	0.21	0.05	-1.19	-0.34	-3.56	0.00	19.25
June-July		**-0.18**	**0.16**	**0.03**	**-0.50**	**0.14**	**-1.10**	**0.27**	
July-August	Norris et al., 2010	-0.11	0.07	0.00	-0.25	0.02	-1.64	0.10	46.48
July-August	Palinkas et al., 2000a	-0.35	0.24	0.06	-0.82	0.13	-1.42	0.16	9.79
July-August	Palinkas et al., 2000b	0.03	0.13	0.02	-0.23	0.28	0.20	0.84	25.17
July-August	Palinkas et al., 2000c	-0.31	0.39	0.15	-1.07	0.46	-0.79	0.43	4.16
July-August	Weiss et al., 2004	0.27	0.19	0.04	-0.11	0.64	1.38	0.17	14.40
July-August		**-0.05**	**0.08**	**0.01**	**-0.21**	**0.11**	**-0.66**	**0.51**	
August-September	Norris et al., 2010	0.08	0.07	0.01	-0.06	0.22	1.15	0.25	79.65
August-September	Palinkas et al., 2000a	0.41	0.25	0.06	-0.07	0.90	1.66	0.10	6.55
August-September	Palinkas et al., 2000c	-0.05	0.39	0.15	-0.82	0.71	-0.14	0.89	2.63
August-September	Weiss et al., 2004	0.05	0.19	0.04	-0.32	0.43	0.29	0.77	11.17
August-September		**0.10**	**0.06**	**0.00**	**-0.03**	**0.22**	**1.53**	**0.13**	
September-October	Norris et al., 2010	-0.11	0.09	0.01	-0.27	0.06	-1.25	0.21	72.66
September-October	Palinkas et al., 2000a	0.11	0.24	0.06	-0.36	0.57	0.44	0.66	9.22
September-October	Palinkas et al., 2000c	-0.09	0.38	0.14	-0.83	0.65	-0.23	0.81	3.65
September-October	Weiss et al., 2004	-0.19	0.19	0.04	-0.56	0.19	-0.99	0.32	14.46
September-October		**-0.10**	**0.07**	**0.01**	**-0.24**	**0.04**	**-1.35**	**0.18**	

Statistics for each study



Meta Analysis

Figure 9. Forest plot of studies included in Analysis Two.

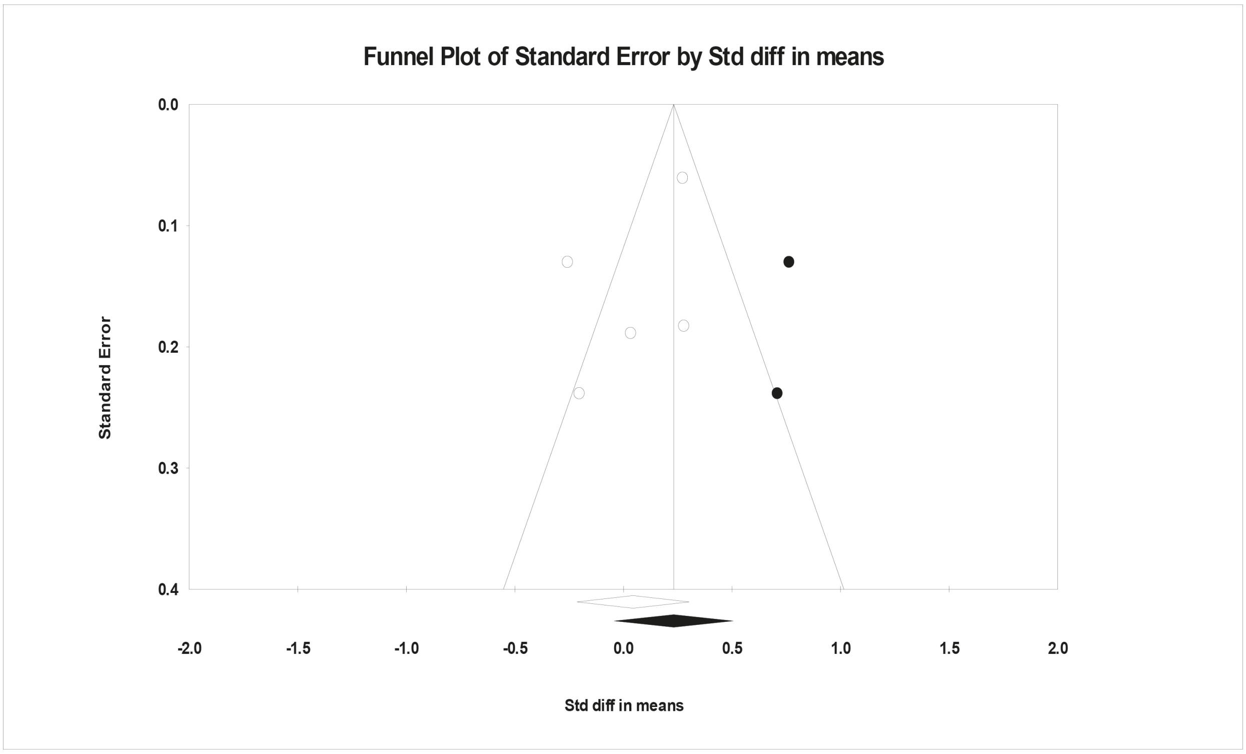


Figure 10. Funnel plot for studies included in Analysis Two at time-point March-April.

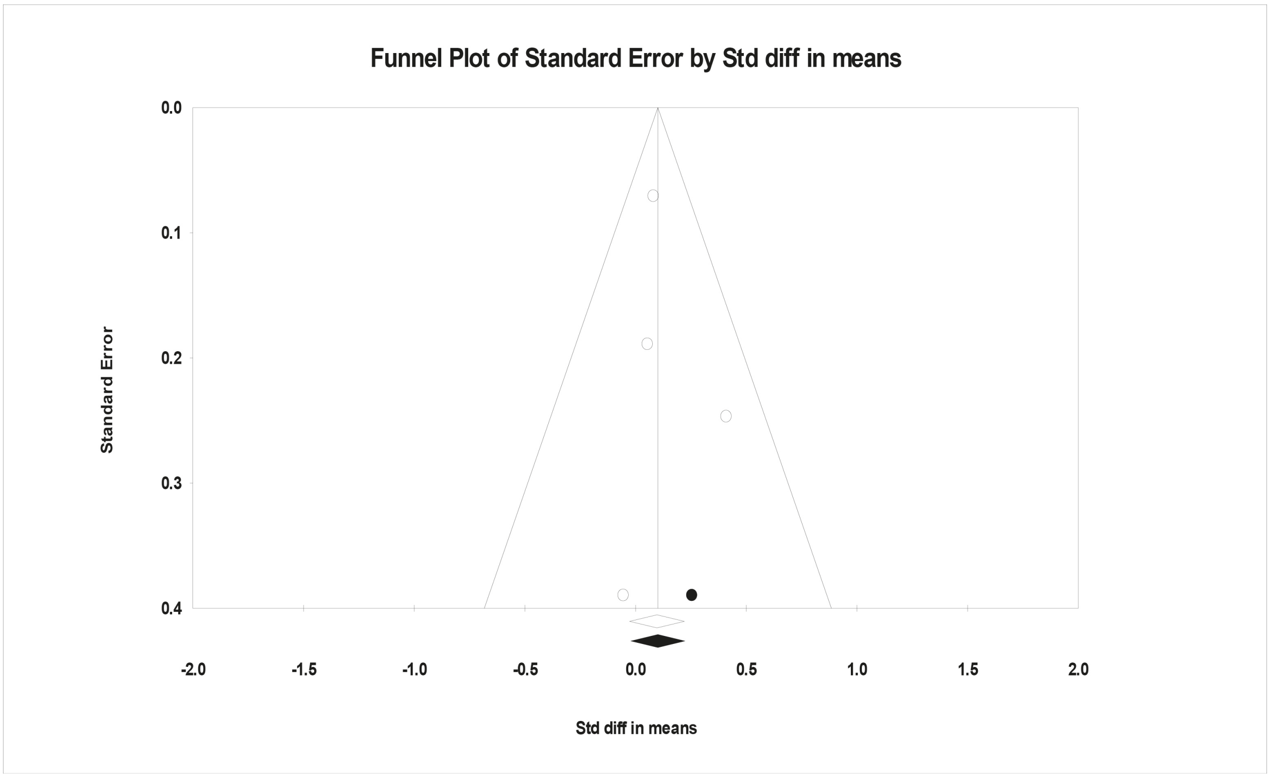
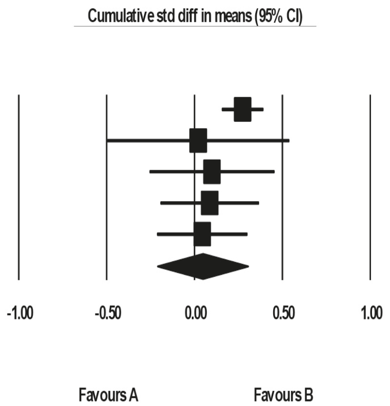


Figure 11. Funnel plot for studies included in Analysis Two at time-point August-September.

Study name	Time point	Point	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value	Relative weight
Norris et al., 2010	March-April	0.27	0.06	0.00	0.15	0.39	4.49	0.00	26.79
Palinkas et al., 2000b	March-April	0.02	0.26	0.07	-0.50	0.54	0.08	0.94	49.02
Oliver, 1991	March-April	0.10	0.18	0.03	-0.26	0.46	0.55	0.58	67.37
Weiss et al., 2004	March-April	0.09	0.14	0.02	-0.19	0.37	0.60	0.55	85.30
Palinkas et al., 2000a	March-April	0.04	0.13	0.02	-0.21	0.30	0.34	0.74	100.00
		0.04	**0.13**	**0.02**	**-0.21**	**0.30**	**0.34**	**0.74**	

Cumulative statistics



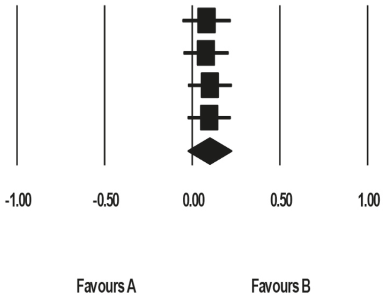
Meta Analysis

Figure 12. Cumulative meta-analysis for Analysis Two at time-point March-April.

Study name	Time point	Point	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value	Relative weight
Norris et al., 2010	August-September	0.08	0.07	0.01	-0.06	0.22	1.15	0.25	79.65
Weiss et al., 2004	August-September	0.08	0.07	0.00	-0.05	0.21	1.18	0.24	90.82
Palinkas et al., 2000a	August-September	0.10	0.06	0.00	-0.02	0.23	1.57	0.12	97.37
Palinkas et al., 2000c	August-September	0.10	0.06	0.00	-0.03	0.22	1.53	0.13	100.00
		0.10	0.06	0.00	-0.03	0.22	1.53	0.13	

Cumulative statistics

Cumulative std diff in means (95% CI)



Meta Analysis

Figure 13. Cumulative meta-analysis for Analysis Two at time-point August-September.

Once the methodological limitation of small sample sizes is removed, can an overall negative impact on psychological functioning in Antarctic personnel be universally identified?

Summer deployment data (Analysis Three).

Characteristics of studies included in Analysis Three are listed in Table 3. There was a trivial positive effect between baseline and end of deployment scores of negative mood for summer deployment, indicating on average, negative mood scores were higher at baseline than the end of deployment (Figure 14).

Assessment of heterogeneity.

As shown in table 5, included studies were found to be highly heterogeneous, indicating there was substantial variability in the effect sizes between studies.

Assessment of publication bias.

A funnel plot for this analysis is shown in Figure 15; under the random effects model the point estimate and 95% CI for the combined studies was 0.14 (-0.36, 0.63). Using Trim and Fill these values are unchanged. The cumulative meta-analysis showed no positive drift, indicating no small sample size effects (Figure 16).

Table 3
Studies Included in Analysis Three:

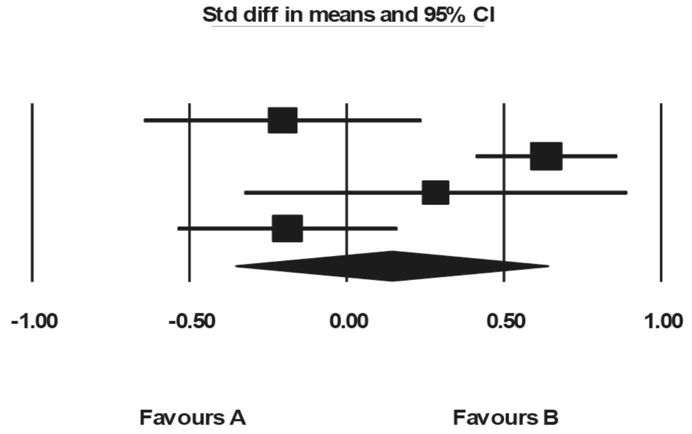
Author	YoP	YoD	SS	G	DS	RB	N	CO	SP	NMS	ToP	SMA
Khandelwal et al.,	2015	2007-2008	33	100% Male	Summer	Maitri	Indian	C		General Health Questionnaire: Composite score of anxiety and insomnia and depression subscale	Journal Article	Descriptive and Inferential Statistics
Norris	2010	2005-2009		72% Male	Summer	Casey, Davis, and Mawson	Australian	I	Scientific Discipline/ Logistical Support	Hopkins Symptom Checklist (21 item version): General Distress subscale	PhD Thesis	Descriptive Statistics
Peri et al.,	2000		11	100% Male	Summer	Terra Nova Bay	Italian	I	Scientific Discipline/ Logistical Support	Profile of Mood States: Composite Total Mood Disturbance	Journal Article	Descriptive Statistics

Ursin, et al.,	1991	1989-1990	20	100% Male	Summer		Norwegian	I	Scientific Discipline/ Logistical Support	Scale Score State-Trait Anxiety Inventory: State Anxiety Subscale	Journal Article	Descriptive Statistics

Note. YoP = Year of Publication; YoD = Year of Data Collection; SS = Sample Size; G = Gender; DS = Deployment Season; RB = Research Base; N = Nationality; CO = Cultural Orientation, I = Individualistic, C = Collectivist; SP = Sample Population; NMS = Negative Mood Scale; ToP = Type of Publication; SMA = Statistics used in Meta-analysis.

Study name	Std diff in means	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value	Relative weight
Ursin et al., 1991	-0.20	0.23	0.05	-0.65	0.24	-0.90	0.37	24.41
Norris, 2010	0.64	0.12	0.01	0.41	0.86	5.50	0.00	28.49
Peri et al., 2000	0.28	0.31	0.10	-0.33	0.89	0.91	0.36	20.78
Khandelwal et al., 2015	-0.19	0.18	0.03	-0.54	0.16	-1.05	0.29	26.32
	0.14	**0.25**	**0.06**	**-0.36**	**0.64**	**0.56**	**0.58**	

Statistics for each study



Meta Analysis

Figure 14. Forest Plot of studies included in Analysis Three.

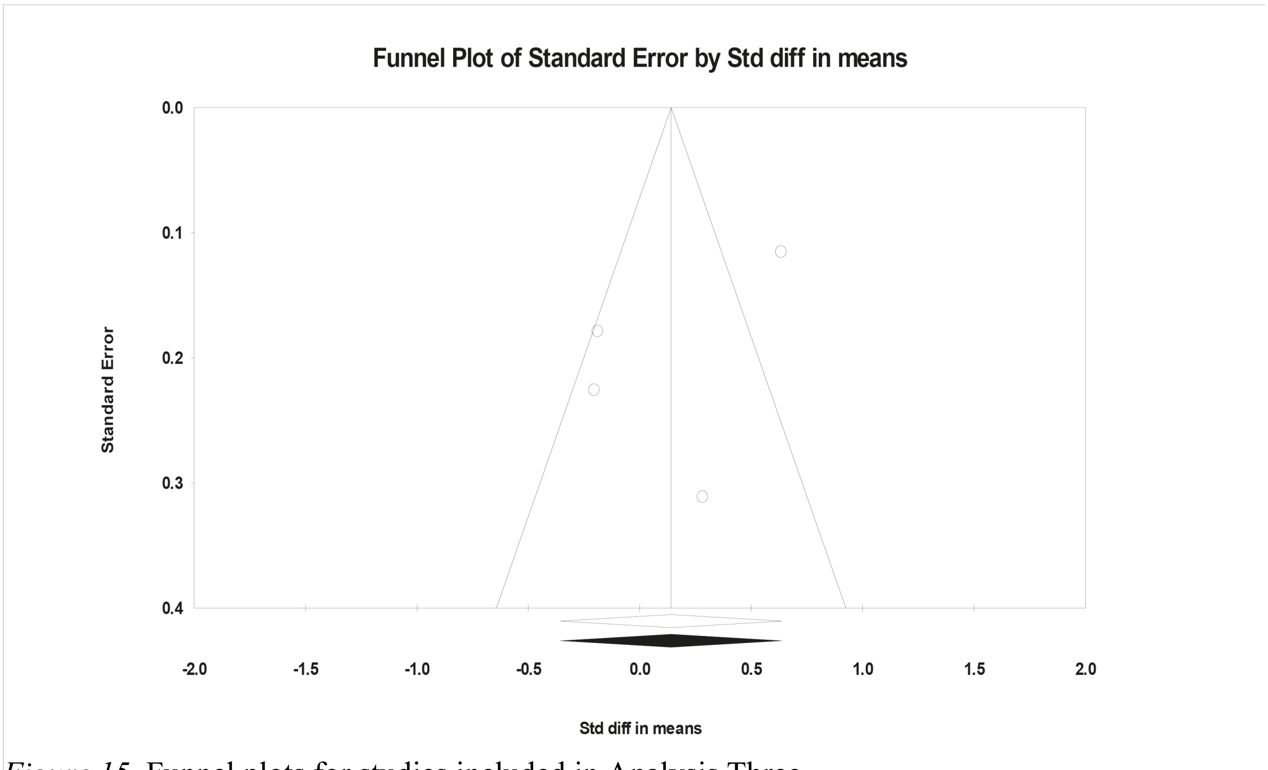
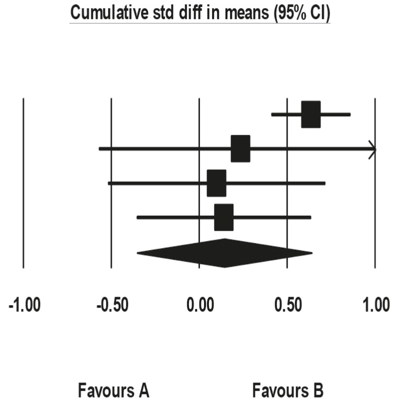


Figure 15. Funnel plots for studies included in Analysis Three.

Study name	Point	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value	Relative weight
Norris, 2010	0.635	0.116	0.013	0.409	0.862	5.497	0.000	28.49
Khandelwal et al., 2015	0.235	0.411	0.169	-0.571	1.041	0.571	0.568	54.81
Ursin et al., 1991	0.099	0.316	0.100	-0.520	0.718	0.314	0.753	79.22
Peri et al., 2000	0.141	0.253	0.064	-0.356	0.637	0.555	0.579	100.00
	0.141	**0.253**	**0.064**	**-0.356**	**0.637**	**0.555**	**0.579**	



Meta Analysis

Figure 16. Cumulative meta-analysis for Analysis Three.

Winter deployment data (Analysis Four).

Characteristics of studies included in Analysis Four are listed in Table 4. There was a trivial positive effect size between baseline and end of deployment scores of negative mood for winter deployment personnel, indicating on average, negative mood scores were higher at baseline than end of deployment (Figure 17).

Assessment of heterogeneity.

As shown in Table 5, the included studies were found to be highly heterogeneous, indicating there was substantial variability in the effect sizes between studies.

Assessment of publication bias.

A funnel plot for this analysis is shown in Figure 18; under the random effects model the point estimate and 95% CI for the combined studies was 0.23 [-0.05, 0.30]. Using Trim and Fill one study was imputed, resulting in an adjusted point estimate of 0.25 [0.00, 0.32]. The cumulative meta-analysis showed no positive drift, indicating no small sample size effects (Figure 19).

Table 4
Studies Included in Analysis Four

Author	YoP	YoD	SS	G	DS	RB	N	CO	SP	NMS	ToP	SMA
Barbarito et al.,	2001	1998	9	100% Male	Winter-Over	Belgrano II	Argentine	C	Scientific Discipline/ Logistical Support	Focusing on and venting Emotion (FVE) Subscale of the COPE test	Journal Article	Descriptive and Inferential Statistic
Bhargava et al.,	2000	1992-1993	25	100% Male	Winter-Over	Maitri	Indian	C	Scientific Discipline/ Logistical Support	Satisfaction with work and life situations	Journal Article	Descriptive and Inferential Statistic
Chen et al.,	2016a	2003	12	100% Male	Winter-Over	Great Wall station	Chinese	C	Scientific Discipline/ Logistical Support	Profile of Moods Scale: Total Mood Disturbance Subscale	Journal Article	Descriptive Statistic
Chen et al.,	2016b	2003	16	100% Male	Winter-Over	Zhongshan	Chinese	C	Scientific Discipline/ Logistical Support	Profile of Moods Scale: Total Mood Disturbance Subscale	Journal Article	Descriptive Statistic

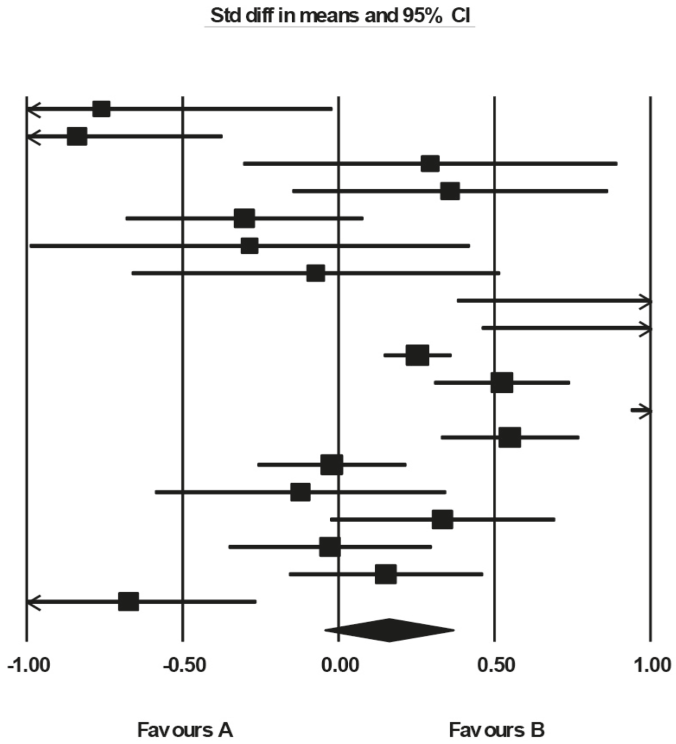
Harris et al.,	2010	1999-2007	55	89% Male	Winter-Over	Rothera and Halley Research Station	British	I	Scientific Discipline/ Logistical Support	Pseudoneurological Complaints of Depression and Anxiety	Journal Article	Descriptive Statistic
Ikegawa et al,,	1998	1990-1992	8	100% Male	Winter-Over	Asuka Station	Japanese	C	Scientific Discipline/ Logistical Support	Anxiety Sensitivity Index	Journal Article	Descriptive Statistic
McCormick et al.,	1985		11		Winter-Over		Mixed (Argentina; Australia; New Zealand; British; French)		Scientific Discipline/ Logistical Support	Hopkins Symptoms Checklist: Total Distress Score	Journal Article	Descriptive Statistic
Mocellin et al.,	2000		13	100% Male	Winter-Over	Marambio and Esperanza	Argentine	C	Military	State-Trait Anxiety Inventory: State Anxiety Subscale	Journal Article	Inferential Statistic
Nicolas et al.,	2015		14	93% Male	Winter-Over	Concordia	French and Italian	I	Scientific Discipline/ Logistical Support	Total Stress Score of the Recovery Stress Questionnaire	Journal Article	Descriptive and Inferential Statistic
Norris	2010	2005-2009	423	72% Male	Winter-Over	Casey, Davis,	Australian	I	Scientific Discipline/	Hopkins Symptom	PhD Thesis	Descriptive Statistic

						Mawson			Logistical Support	Checklist (21 item version): General Distress subscale		
Palinkas et al.,	1995	1988-1989	91	84.30 %	Winter-Over		American	I	Military/ Scientific Discipline/Logistical Support	Research Diagnostic Criteria	Journal Article	Descriptive Statistic
Palinkas et al.,	1995	1988-1989	89	84% Male	Winter-Over	McMurdo, Amundsen-Scott and Palmer	American	I	Military/ Scientific Discipline/Logistical Support	Research Diagnostic Criteria: Global Depressive Symptom Score	Journal Article	Descriptive Statistic
Palinkas et al.,	1996	1990	67	100% Male	Winter-Over	Palmer, South Pole, McMurdo	American	I	Military/ Scientific Discipline/Logistical Support	21 item Hamilton Depression Rating Scale	Journal Article	Descriptive and Inferential Statistic
Palinkas et al.,	1991	1988-1989	155		Winter-Over	McMurdo Station	American	I	Military/ Scientific Discipline/Logistical Support	Research Diagnostic Criteria	Journal Article	Descriptive Statistic
Palinkas et al.,	2000	1991	87	78%	Winter-Over	South Pole	American	I	Military/ Scientific	Profile of Mood States:	Journal Article	Descriptive Statistic

						Station, McMurdo Station and Palmer station			Discipline/Logistical Support	Total Mood Disturbance Scale		
Weiss et al.,	2004		32	100% Male	Winter-Over	Dumont-d'Urville	French	I	Scientific Discipline/ Logistical Support	Negative Polarity Journal Entries	Journal Article	Descriptive Statistic
Weiss et al.,	2000a	1991	31	100% Male	Winter-Over	Asuka Station	Japanese	C	Scientific Discipline/ Logistical Support	Anxiety Sensitivity Index	Journal Article	Descriptive Statistic
Weiss et al.,	2000b	1992	36	100% Male	Winter-Over	Asuka Station	Japanese	C	Scientific Discipline/ Logistical Support	Anxiety Sensitivity Index	Journal Article	Descriptive Statistic
Weiss et al.,	2000c	1993	40	100% Male	Winter-Over	Asuka Station	Japanese	C	Scientific Discipline/ Logistical Support	Anxiety Sensitivity Index	Journal Article	Descriptive Statistic

Note. YoP = Year of Publication; YoD = Year of Data Collection; SS = Sample Size; G = Gender; DS = Deployment Season; RB = Research Base; N = Nationality; CO = Cultural Orientation, I = Individualistic, C = Collectivist; SP = Sample Population; NMS = Negative Mood Scale; ToP = Type of Publication; SMA = Statistics use in Meta-analysis.

Study name	Cultural Dimension	Std diff in means	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value	Relative weight
Barbarito et al., 2001	Collectivist	-0.76	0.38	0.14	-1.50	-0.02	-2.01	0.04	3.66
Bhargava et al., 2000	Collectivist	-0.84	0.24	0.06	-1.30	-0.37	-3.52	0.00	5.14
Chen et al., 2016a	Collectivist	0.29	0.31	0.09	-0.31	0.89	0.96	0.34	4.37
Chen et al., 2016b	Collectivist	0.36	0.26	0.07	-0.15	0.87	1.38	0.17	4.90
Harris et al., 2010	Individualistic	-0.30	0.19	0.04	-0.68	0.08	-1.55	0.12	5.63
Ikegawa et al., 1998	Collectivist	-0.28	0.36	0.13	-0.99	0.42	-0.79	0.43	3.83
McCormick et al., 1985	Individualistic	-0.07	0.30	0.09	-0.66	0.52	-0.24	0.81	4.42
Mocellin et al., 2000	Collectivist	1.06	0.35	0.12	0.38	1.74	3.05	0.00	3.97
Nicolas et al., 2015	Individualistic	1.13	0.34	0.12	0.46	1.80	3.30	0.00	4.01
Norris, 2010	Individualistic	0.25	0.06	0.00	0.14	0.36	4.55	0.00	6.85
Palinkas et al., 1995	Individualistic	0.52	0.11	0.01	0.31	0.74	4.69	0.00	6.47
Palinkas et al., 1991	Individualistic	1.32	0.19	0.04	0.94	1.70	6.78	0.00	5.63
Palinkas et al., 1995	Individualistic	0.55	0.11	0.01	0.33	0.77	4.83	0.00	6.45
Palinkas et al., 1996	Individualistic	-0.02	0.12	0.01	-0.26	0.22	-0.17	0.86	6.38
Palinkas et al., 2000a	Individualistic	-0.12	0.24	0.06	-0.59	0.35	-0.51	0.61	5.13
Weiss et al., 2000a	Collectivist	0.33	0.18	0.03	-0.03	0.70	1.81	0.07	5.74
Weiss et al., 2000b	Collectivist	-0.03	0.17	0.03	-0.35	0.30	-0.16	0.87	5.94
Weiss et al., 2000c	Collectivist	0.15	0.16	0.03	-0.16	0.46	0.96	0.34	6.02
Weiss et al., 2004	Individualistic	-0.67	0.21	0.04	-1.08	-0.26	-3.22	0.00	5.46
		0.16	**0.10**	**0.01**	**-0.05**	**0.36**	**1.51**	**0.13**	



Meta Analysis

Figure 17. Forrest plot of studies included in Analysis Four.

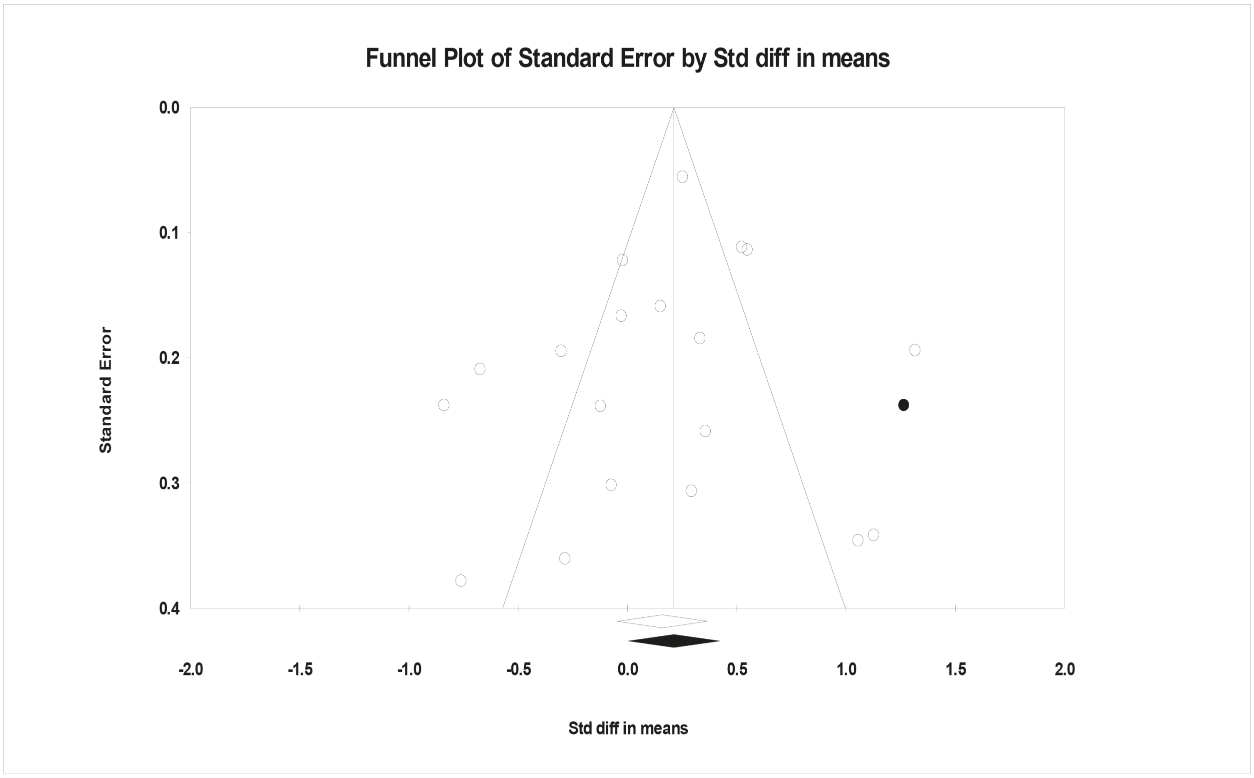
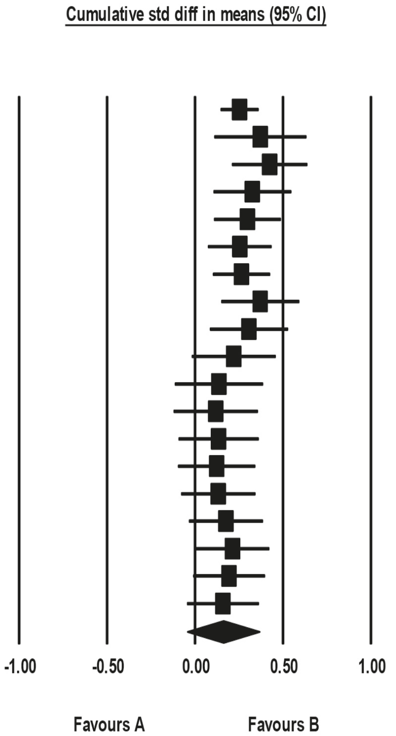


Figure 18. Funnel plot for studies included in Analysis Four.

Study name	Point	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value	Relative weight
	Cumulative statistics							
Norris, 2010	0.254	0.056	0.003	0.144	0.363	4.553	0.000	6.85
Palinkas et al., 1995	0.371	0.134	0.018	0.108	0.635	2.768	0.006	13.32
Palinkas et al., 1995	0.424	0.110	0.012	0.209	0.640	3.857	0.000	19.77
Palinkas et al., 1996	0.326	0.114	0.013	0.103	0.549	2.868	0.004	26.15
Weiss et al., 2000c	0.298	0.098	0.010	0.107	0.490	3.049	0.002	32.17
Weiss et al., 2000b	0.255	0.093	0.009	0.073	0.437	2.742	0.006	38.11
Weiss et al., 2000a	0.264	0.083	0.007	0.101	0.428	3.167	0.002	43.85
Palinkas et al., 1991	0.371	0.114	0.013	0.148	0.594	3.259	0.001	49.49
Harris et al., 2010	0.307	0.114	0.013	0.083	0.530	2.689	0.007	55.11
Weiss et al., 2004	0.220	0.122	0.015	-0.019	0.460	1.801	0.072	60.58
Bhargava et al., 2000	0.136	0.129	0.017	-0.116	0.389	1.059	0.290	65.71
Palinkas et al., 2000a	0.118	0.123	0.015	-0.123	0.359	0.961	0.336	70.84
Chen et al., 2016b	0.134	0.117	0.014	-0.095	0.363	1.147	0.252	75.74
McCormick et al., 1985	0.123	0.113	0.013	-0.098	0.344	1.093	0.275	80.17
Chen et al., 2016a	0.132	0.109	0.012	-0.080	0.345	1.219	0.223	84.54
Nicolas et al., 2015	0.176	0.108	0.012	-0.036	0.388	1.627	0.104	88.55
Mocellin et al., 2000	0.213	0.107	0.011	0.003	0.423	1.990	0.047	92.52
Ikegawa et al., 1998	0.194	0.105	0.011	-0.012	0.399	1.845	0.065	96.34
Barbarito et al., 2001	0.159	0.105	0.011	-0.047	0.364	1.515	0.130	100.00
	0.159	**0.105**	**0.011**	**-0.047**	**0.364**	**1.515**	**0.130**	



Meta Analysis

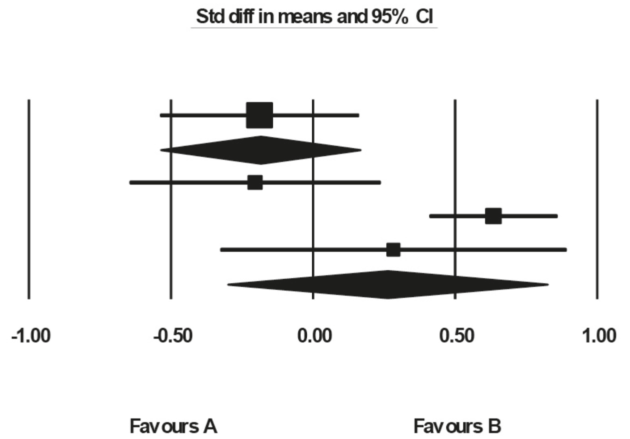
Figure 19. Cumulative meta-analysis for Analysis Four.

Is culture a moderating factor on mood fluctuations in Antarctic personnel?

Summer deployment data.

In this moderation analysis, effect sizes obtained in the random effects analysis were coded according to personnel cultural orientation (individualistic culture = 1, collectivist culture = 2). For personnel from an individualistic culture, a small positive effect size was identified, indicating that negative mood was greater at baseline, in comparison to the end of deployment, whilst for personnel from a collectivist culture, a trivial negative effect size was identified, indicating negative mood was greater at the end of deployment, in comparison to baseline (Figure 20). Overall cultural orientation did not account for the significant heterogeneity in the model.

Group by Culture	Study name	Std diff in means	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value	Relative weight
Collectivist	Khandelwal et al., 2015	-0.19	0.18	0.03	-0.54	0.16	-1.05	0.29	100.00
Collectivist		**-0.19**	**0.18**	**0.03**	**-0.54**	**0.16**	**-1.05**	**0.29**	
Individualistic	Ursin et al., 1991	-0.20	0.23	0.05	-0.65	0.24	-0.90	0.37	33.08
Individualistic	Norris, 2010	0.64	0.12	0.01	0.41	0.86	5.50	0.00	38.99
Individualistic	Peri et al., 2000	0.28	0.31	0.10	-0.33	0.89	0.91	0.36	27.93
Individualistic		**0.26**	**0.29**	**0.08**	**-0.30**	**0.82**	**0.90**	**0.37**	



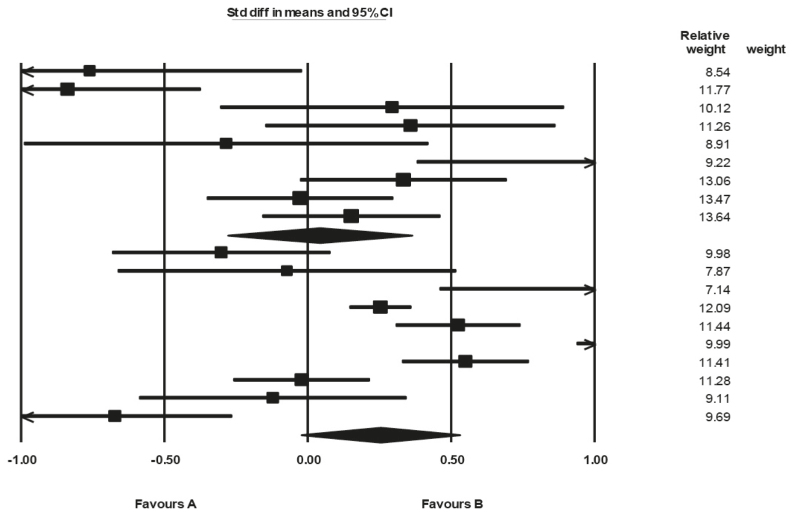
Meta Analysis

Figure 20. Forest plot of studies included in the moderation analysis for summer deployment data.

Winter deployment data.

In this moderation analysis personnel cultural orientation was again examined. For personnel from an individualistic culture, a small positive effect size was identified, indicating that negative mood was greater at baseline in comparison to the end of deployment, whilst a trivial positive effect size was identified for personnel from a collectivist culture, also indicating that negative mood was greater at baseline in comparison to the end of deployment (Figure 21). Overall cultural orientation did not account for the significant heterogeneity in the model.

Group by Cultural Dimension	Study name	Cultural Dimension	Std diff in means	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value	Relative weight
Collectivist	Barbarito et al., 2001	Collectivist	-0.76	0.38	0.14	-1.50	-0.02	-2.01	0.04	8.54
Collectivist	Bhargava et al., 2000	Collectivist	-0.84	0.24	0.06	-1.30	-0.37	-3.52	0.00	11.77
Collectivist	Chen et al., 2016a	Collectivist	0.29	0.31	0.09	-0.31	0.89	0.96	0.34	10.12
Collectivist	Chen et al., 2016b	Collectivist	0.36	0.26	0.07	-0.15	0.87	1.38	0.17	11.26
Collectivist	Ikegawa et al., 1998	Collectivist	-0.28	0.36	0.13	-0.99	0.42	-0.79	0.43	8.91
Collectivist	Mocellin et al., 2000	Collectivist	1.06	0.35	0.12	0.38	1.74	3.05	0.00	9.22
Collectivist	Weiss et al., 2000a	Collectivist	0.33	0.18	0.03	-0.03	0.70	1.81	0.07	13.06
Collectivist	Weiss et al., 2000b	Collectivist	-0.03	0.17	0.03	-0.35	0.30	-0.16	0.87	13.47
Collectivist	Weiss et al., 2000c	Collectivist	0.15	0.16	0.03	-0.16	0.46	0.96	0.34	13.64
Collectivist			**0.04**	**0.16**	**0.03**	**-0.28**	**0.36**	**0.24**	**0.81**	
Individualistic	Harris et al., 2010	Individualistic	-0.30	0.19	0.04	-0.68	0.08	-1.55	0.12	9.98
Individualistic	McCormick et al., 1985	Individualistic	-0.07	0.30	0.09	-0.66	0.52	-0.24	0.81	7.87
Individualistic	Nicolas et al., 2015	Individualistic	1.13	0.34	0.12	0.46	1.80	3.30	0.00	7.14
Individualistic	Norris, 2010	Individualistic	0.25	0.06	0.00	0.14	0.36	4.55	0.00	12.09
Individualistic	Palinkas et al., 1995	Individualistic	0.52	0.11	0.01	0.31	0.74	4.69	0.00	11.44
Individualistic	Palinkas et al., 1991	Individualistic	1.32	0.19	0.04	0.94	1.70	6.78	0.00	9.99
Individualistic	Palinkas et al., 1995	Individualistic	0.55	0.11	0.01	0.33	0.77	4.83	0.00	11.41
Individualistic	Palinkas et al., 1996	Individualistic	-0.02	0.12	0.01	-0.26	0.22	-0.17	0.86	11.28
Individualistic	Palinkas et al., 2000a	Individualistic	-0.12	0.24	0.06	-0.59	0.35	-0.51	0.61	9.11
Individualistic	Weiss et al., 2004	Individualistic	-0.67	0.21	0.04	-1.08	-0.26	-3.22	0.00	9.69
Individualistic			**0.25**	**0.14**	**0.02**	**-0.03**	**0.53**	**1.78**	**0.08**	



Meta Analysis

Figure 21. Forest plot of studies included in the moderation analysis for winter deployment data.

Table 5
Inferential and Heterogeneity Assessment Statistics

Analysis	*d*	95% CI [LL, UL]	p	Q	df (Q)	p	I^2
Analysis One							
March-April	0.04	[-0.22, 0.30]	0.74	16.85	4	0.01	76.26
March-May	-0.14	[-0.43, 0.16]	0.36	21.78	4	0.01	81.63
March-June	0.07	[-0.06, 0.21]	0.27	5.01	4	0.27	20.19
March-July	-0.23	[-0.61, 0.15]	0.24	22.08	3	0.01	86.41
March-August	-0.18	[-0.42, 0.06]	0.15	13.80	4	0.01	71.01
March-September	-0.12	[-0.50, 0.26]	0.53	8.37	2	0.01	76.12
March-October	-0.21	[-0.61, 0.17]	0.28	8.12	2	0.01	75.37
Analysis Two							
March-April	0.04	[-0.22, 0.30]	0.13	16.84	4	0.02	76.25
April-May	-0.15	[-0.40, 0.10]	0.24	15.23	4	0.04	73.73
May-June	0.14	[-0.11, 0.39]	0.27	17.77	5	0.03	71.87
June-July	-0.18	[-0.50, 0.14]	0.27	18.99	4	0.01	78.94
July-August	-0.05	[-0.22, 0.11]	0.51	5.63	4	0.23	28.91
August-September	0.10	[-0.03, 0.22]	0.13	1.86	3	0.60	0.00
September-October	-0.10	[-0.24, 0.04]	0.18	0.95	3	0.81	0.00
Analysis Three							
Baseline–End of Deployment	0.14	[-.36, 0.64]	0.58	20.82	3	0.01	85.59
Moderation				1.75	1	0.19	
Individualistic	0.26	[-0.30, 0.82]					
Collectivist	-0.19	[-0.54, 0.16]					
Analysis Four							
Baseline–End of Deployment	0.16		.130	124.62	18	0.01	85.56
Moderation				0.97	1	0.32	
Individualistic	0.28	[0.20, 0.35]					
Collectivist	0.04	[-0.28, 0.33]					

Note. d = Cohen’s d; CI = Confidence Interval, LL = Lower Limit, UL = Upper Limit

Discussion

The current meta-analysis examined whether there was evidence of time-dependent mood fluctuations in Antarctic populations. To achieve this, four analyses were conducted to investigate three research questions of interest.

Are Mood Fluctuations in Antarctic Personnel Consistent with the Proposed Parameters of the 'Third-Quarter Phenomenon' when Available Data are Analysed within Monthly Intervals?

To investigate this research question, two repeated-measures all time-points analyses using random effects models were conducted on datasets containing monthly measurements of negative mood. Analysis One compared monthly negative mood to a baseline negative mood score, with baseline operationalised as the first month of the winter deployment period (March). Analysis Two assessed negative mood progressively across the winter deployment period. To show support for the third-quarter phenomenon, a significant increase in negative mood during August and September was required; yet this was not identified, as trivial effect sizes were found in both analyses one and two in August and September. Therefore, the findings do not support the proposed parameters of the third-quarter phenomenon.

These findings suggest that previous research which had identified mood fluctuations consistent with the third-quarter phenomenon may have been confounded by the data collection or analysis methods being utilised, as a number of studies can be identified as either collecting data in quarters (McCormick, Taylor, Rivolier, & Cazes, 1985; Stuster et al., 2000), or analysing and reporting data in quarters despite collecting data in monthly intervals (Palinkas, Johnson, Boster & Houseal, 1998; Palinkas et al., 2004). This notion is further supported by analyses one and two identifying a decrease in negative mood in June. When data are analysed in quarters this decrease in negative mood would fall in the second quarter, thus decreasing the overall negative mood average for the second quarter. Therefore, when negative mood returns to the approximate baseline identified in the majority of months during the winter deployment period, it appears that negative mood increases. This would result in an increased negative mood average in the third-quarter, thus creating the appearance of a 'peak' in negative mood, paralleling the proposed parameters of the third-quarter phenomenon.

The postulation that negative mood would increase at the third-quarter point of deployment in Antarctica holds limited validity when considering the factors which may impact mood fluctuations. The third-quarter point of winter deployment falls at the end of August. At this point, the longest day of winter (21st June) has passed, resulting in twilight and daylight hours beginning to increase (AAD, 2014), as well as increases in the average temperature (Australian Bureau of Meteorology, 2016). The improving weather conditions allow personnel to engage in off-station activities, which has been correlated with a decrease in negative mood (Wood, Hysong, Lugg, & Harm, 2000). Therefore, from the perspective of the physical parameters influence on mood, it is unlikely that these factors would result in an increase in negative mood.

Concurrently, the postulation that negative mood would peak at the third-quarter of deployment has limited support from the perspective of the social parameters experienced during deployment in Antarctica. August marks the beginning of the post-winter fly in ('Winfly'), during which a small number of new personnel and supplies arrive in Antarctica via plane to prepare for the peak research season in summer. Yet if the arrival of new crew and supplies were a contributing factor to an increase in negative mood, we would predict a peak over and above what would be reported in August, in October. During October the majority of incoming 'Winfly' flights occur, resulting in a 75% population increase in most research bases. Therefore, if the increase in the population on research bases was to negatively impact on mood, it would be more valid to assume that negative mood would increase in October, which falls in the fourth-quarter (not third-quarter) of deployment.

Despite the current results showing no significant fluctuations in mood during the winter deployment period, analysing in monthly intervals identified several points where mood observably fluctuated. Analysis One (monthly by baseline) and analysis Two (monthly progressively) showed a decrease in negative mood in June. The 21st of June signifies the shortest day of the year, with the event celebrated with mid-winter festivities at a majority of Antarctic bases. As a decrease in negative mood in June coincides with such a significant milestone in the Antarctic social calendar, this suggests that the social parameters and events that occur within the research bases during the winter-over period may impact the mood of personnel.

Analysis One and Two also indicated an increase in negative mood in October, which is the final month of the winter deployment period. As indicated, this increase in negative mood coincides with the end of 'Winfly' and the change in deployment seasons and personnel teams. Relatively little research has been conducted on the impact of 'Winfly' on personnel deployed during the winter-over period, yet qualitative research by Cravalho (1996) suggested that winter-over personnel were resistant to new personnel and were commonly perceived by incoming personnel as disgruntled and irritable, suggesting an increase in negative mood.

Theoretical and practical implications.

As the current analysis does not support the proposed parameters of the third-quarter phenomenon it has significant theoretical implications, as this has been the dominant model used to investigate the psychological impacts of Antarctic deployment. Analysing data in monthly intervals indicated that mood fluctuated constantly throughout deployment, yet to date there is no theoretical framework to justify why this is occurring. Furthermore, the identification that mood may be impacted by the changing social parameters and dynamics within the base suggests that this may be an important moderator to investigate in future research. Gaining a deeper understanding of how the changing social parameters and dynamics impact on personnel may assist in understanding the underlying mechanisms which impact upon psychological functioning during Antarctic deployments.

Furthermore, this finding has implications from a research and organisational perspective. Firstly, from a research perspective, it indicated that a change in the way data are collected, analysed, and reported is required. Arguably, smaller weekly intervals between assessments of psychological functioning would provide the greatest insight into adaptation and functioning during deployment. However, this may also be impractical due to the restraints and work schedules of Antarctic personnel. Therefore, it is suggested that measuring psychological functioning monthly holds the greatest utility, as it will parallel the monthly medical check-ups, which are mandatory across most Antarctic research bases. From an organisational perspective, the constant fluctuations in mood during the winter deployment period suggest that psychological interventions should not be targeted at any particular point of deployment. Instead, prevention strategies aimed at reducing the likelihood of mood fluctuations reaching a detrimental level may be most beneficial to overall personnel adaptation and functioning (Norris, 2010).

Once the Methodological Limitation of Small Sample Sizes is removed, can an Overall Impact on Psychological Functioning in Antarctic Personnel be Universally Identified?

To investigate this question, an analysis for summer deployment data (Analysis Three) and winter deployment data (Analysis Four) was conducted using random effects models, on datasets containing baseline and end of deployment measurements of negative mood. Analysis Three and Four found a non-significant trivial positive effect size, indicating that negative mood was higher at baseline, in comparison to the end of deployment in both deployment seasons. Therefore, these results suggest that deployment in Antarctica does not have a detrimental impact to psychological functioning in either the summer or winter deployment period.

Although trivial, a positive effect size in both analyses (indicating that negative mood is higher at baseline in comparison to the end of deployment) suggests that the lead-up phase to Antarctic deployment may be more detrimental to functioning than the actual deployment period itself. The pre-deployment phase extends from when preparations for deployment to Antarctica begin until personnel physically depart for Antarctica (Norris, 2010). As there is limited formal research investigating the impacts of pre-deployment on Antarctic personnel, there is limited insight into why an increase in negative mood may be occurring at this time-point (Norris et al., 2010). However, research on populations deployed in other EUEs, such as military personnel, or for prolonged periods of absence, such as oil rig workers, suggests the pre-departure phase poses unique challenges to the individuals about to be deployed (Norris et al., 2010). The impeding separation from family and existing social supports in these populations has been correlated with feelings of guilt, anger, and emotional withdrawal (Fredrickson, 2001). It is also likely to be associated with cognitive and behavioural preparations for the deployment period, in which there may be substantial renegotiation of roles between partners and within families, including administration demands and parenting obligations (Norris, 2010), all of which may result in an increase in negative mood.

Theoretical and practical implications.

As indicated, there is limited research investigating the impacts of the pre-deployment phase on Antarctic personnel (Norris et al., 2010), therefore the current finding that the pre-deployment phase has an impact on mood suggests that future research should attempt to understand what factors impact personnel functioning in the lead up to Antarctic deployment. Understanding the mechanisms influencing the pre-departure functioning of personnel will not only assist from a theoretical perspective, but also have significant utility from a practical perspective, as it will assist in the adaptation of current training, and development of prevention programs. This in turn may have substantial benefits and flow-on effects for subsequent adjustment and adaptation in later stages of Antarctic deployment (Norris, 2010).

Is Culture a Moderating Factor on Mood Fluctuations in Antarctic Personnel?

The influence of culture on mood fluctuations in Antarctic personnel was assessed using moderation analyses on data sets investigating the overall impact of summer deployment and winter–over deployment periods, respectively.

The moderation analysis for summer deployment data identified that personnel from collectivist cultures had greater levels of negative mood compared to personnel from individualistic cultures. The opposing effect size direction indicates that personnel from individualistic cultures may experience greater negative mood at baseline, whilst personnel from collectivist cultures may experience greater negative mood at the end of the deployment. The moderation analysis for winter deployment data identified that personnel from individualistic cultures had greater levels of negative mood than collectivist cultures at baseline. However, the identified effects were trivial to small and the heterogeneity assumptions of both moderation analyses were not met. This indicates that there was still significant variability between individualistic personnel and collectivist personnel, and that other factors may provide additional explanation for the difference between these two groups.

Individualistic and collectivist cultures differ in terms of how an individual defines oneself. Individuals from individualistic cultures emphasise emotional independence and autonomy. In comparison, individuals from collectivist cultures emphasise collective identity and emotional interdependence (Hofstede, 1983). The characteristics of the respective cultural orientations have been identified as impacting individuals in new social situations, with individuals from an individualistic culture having greater adaptability when entering and exiting new social situations, in comparison to an individual from collectivist cultures (Briley, Wyer, & Li, 2014). These differences between cultural orientations may provide insight into the effect size differences during the summer deployment season, as personnel from an individualistic culture may find it easier to adapt to their new social environment and rely less on pre-existing social supports that are not readily accessible due to the isolation in Antarctica. Further, the short-term separation from their pre-existing social networks may not adversely impact them, nor drive them to develop new social supports, due to having an emotionally independent and autonomous self-concept. In comparison, personnel from collectivist cultures may find the short-term separation from pre-existing social supports more distressing and be less adaptable to their new social environment.

The finding that compared personnel from collectivist cultures, to those from individualistic cultures experienced greater negative mood prior to the winter deployment season, cannot be explained by pre-existing literature as no research has investigated the impact of cultural orientation in the pre-deployment phase. However, assessing the congruence between personnel and organisational cultural orientations may provide some insight. Prior to deployment, all winter deployment personnel undergo training to prepare them for Antarctica (AAD, 2015). During this training organisational values, norms, and guidelines are presented both implicitly (through team-work based activities and training exercises) and explicitly (through the direct delivery of content) (AAD, 2015). During training, organisations emphasise the importance of prioritising the team over that of the individual, and encourage personnel to envision their team as their family (Norris, 2010). These promoted organisational values closely parallel collectivist values, such as interdependence (Briley et al., 2014) and may be incongruent with the values promoted in individualistic cultures. This dissonance between the promoted organisational values and pre-existing values and held by personnel from individualistic cultures may further exacerbate the higher level of negative mood which has been identified as occurring during the pre-deployment phase, thus explaining the increase in negative mood for personnel with an individualistic orientation, in comparison to personnel from a collectivist orientation.

Theoretical and practical implications.

The identification that cultural orientation may impact mood fluctuations suggests that future research should investigate the experiences of personnel from individualistic and collectivist cultures separately, as this may be a potential moderating factor. Gaining a deeper insight into how cultural orientation may moderate adaptation and functioning during deployment has practical implications in the refinement of training and prevention programs for personnel depending upon their cultural orientation and deployment season. Further, gaining a greater insight into how cultural orientation influences adaptation and functioning during Antarctic deployment may have implications for mixed nationality teams in analogue environments such as spaceflights, placing personnel together who experience different amounts of negative mood at different times may have detrimental impacts to team cohesion and productivity if not accounted and prepared for.

Considerations for Interpretation and Recommendations for Future Research

The results of the current meta-analysis can only be interpreted with a number of potential limitations taken into consideration. The quality of a meta-analysis is determined by the studies selected to be included in the analysis (Lipsey & Wilson, 2001). Therefore, a bias in the selection process can detrimentally impact the results and conclusion drawn. To minimise this potential bias, the current meta-analysis stated explicit inclusion and exclusion criteria, and calculated the inter-rater reliability of a random selection of studies that met the explicit criteria. Publication bias is another bias pertaining to the selection process; in which only studies with statistically significant results are readily published (Lipsey & Wilson, 2001). This limitation was addressed by calculating the Trim and Fill method by Duval and Tweedie (2000) and conducting cumulative meta-analyses, as described in the methods.

The ‘apples and oranges’ criticism of meta-analyses, argues that logical and valid conclusions cannot be drawn when aggregating dissimilar studies in terms of scales of measurement, definition of variables, and participants (Sharpe, 1997). This criticism concerns the current meta-analysis due to the diffuse nature of the data included, particularly the wide range of measurement scales utilised in the studies to investigate mood fluctuations in Antarctic personnel, impacting comparability between studies. However, Morris (2007) suggested that this concern depends on the nature of the research questions. The research questions guiding the current analysis are very broad. Further, the body of empirical knowledge associated with the research questions can be argued as niche, thus systematic exclusion on the basis of measurement scales used in the studies could have led to biased results, or no meta-analysis being conducted. The symptoms identified as impacting on an individual during Antarctic deployment include a range of negative mood states including anxiety, depression, agitation, and anger. As all the scales included in the meta-analysis measure one of these outcomes, it can be argued that the current results still provide insight into mood fluctuations, despite the wide variety of scales used. The wide range of scales used suggests a lack of consensus among researchers surrounding how to best measure the psychological impacts of Antarctic deployment. Future research would benefit from either the development of a specific scale, or a consensus between researchers about which pre-existing clinical scale holds the most utility in assessing psychological impacts of Antarctic deployment. This would increase comparability of data collected across Antarctic research bases and decrease the diffuse nature of data in an already inherently difficult research area.

The small sample sizes in the studies included in the meta-analysis can also be identified as a limitation. Small sample sizes are an inherent methodological limitation of Antarctic research due to the small populations available to participate (Bhargava et al., 2000). Unfortunately, this limitation is currently impossible to overcome. Thus systematic reviews and meta-analyses hold value in this area of research, as they help accumulate and summarise existing research, providing a more complete understanding of the data than a stand-alone study can (Shea et al, 2011). Despite this, it must be acknowledged that the inclusion of studies with small sample sizes in meta-analyses can result in lower methodological quality of the meta-analytic outcomes (Greco et al., 2013). The current analysis used weighted effect sizes and cumulative meta-analyses to investigate and limit the bias introduced to the current analysis by small sample sizes. Further, including studies with small sample sizes tends to inflate the overall effect (Button et al., 2013), though as the current analyses identified trivial and small effect sizes, this has not appeared to substantially impact the current results. The need for larger sample sizes in Antarctic research suggests the need for greater collaboration between researchers in future studies. Collaboration between researchers not only increases the potential number of participants available for each study, but may also increase the consistency in data collection methods.

The current meta-analysis was limited in ability to describe the mechanisms influencing mood fluctuations in Antarctic personnel. This constraint stems from both the lack of investigation into potential moderating and mediating factors in the studies, and the descriptive nature of data in this research discipline. Although several moderating and mediating factors have been suggested, including team dynamics (Burke & Feitosa, 2015), leadership (Stuster, 1997), severity of weather conditions (Chen, Wu, Li, Zhang, & Xu, 2016), and culture (Palinkas et al., 2004), very few studies investigating mood fluctuations in Antarctic personnel adequately measure or investigate these factors, resulting in insufficient statistical information. Without future research investigating potential variables associated with these proposed mechanisms, research in this area will remain at the descriptive level and hold limited utility to inform the training and support of personnel. Therefore, future research should aim to progress beyond the descriptive level, as the progression from descriptive to explanatory research will hold greater utility in designing prevention and intervention programs for personnel.

Generalisability of Results

Although results from meta-analyses are considered more generalisable than results from a stand-alone study, the current meta-analysis is constrained by the focus on negative mood. Negative mood is only one component of the identified symptoms impacting upon an individual during Antarctic deployment with deficits in memory, concentration, and fatigue also being identified. As cognitive and physical symptoms were not assessed in the current meta-analysis, the results cannot be generalised to these domains of functioning. As such, future research should aim to accumulate and summarise the respective research in these domains. Furthermore, although research investigating the impact of Antarctic deployment on personnel reflects a primarily pathogenic focus, researchers are increasingly investigating the salutogenic impacts in this domain. Thus, future research may also benefit from summarising salutogenic research in this area, as it has the potential to provide insights into the strategies personnel use to cope in Antarctica (Zimmer et al., 2013), which can be fostered through proactive prevention and training programs.

Conclusion

The current meta-analysis indicated that mood fluctuations in Antarctic personnel are inconsistent with the proposed parameters of the third-quarter phenomenon when the confound of analysing data in quarters is removed. It was identified that negative mood is higher at baseline, in comparison to post deployment, in both summer and winter deployment personnel. Cultural orientation impacted the timing extent to which personnel were likely to experience an increase in negative mood. The present findings have significant theoretical implications, as they do not support the dominant theory utilised when investigating the psychological impacts of deployment in Antarctica. From a practical perspective, the results of the current meta-analysis can be utilised to adjust deployment training and prevention programs depending upon cultural orientation and deployment season.

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Appendix A

Antarctic Facilities List

Research Facility Name	National Program	Year Opened	Facility Type	Operational Status	Winter Population	Peak (Summer) Population
Belgrano II	Argentina	1955	Station	Year-round	12	12
Brown	Argentina	1951	Station	Seasonal		18
Cámara	Argentina	1953	Station	Seasonal		36
Decepcíon	Argentina	1948	Station	Seasonal		65
Esperanza	Argentina	1952	Station	Year-round	55	90
Carlini (formally known as Jubany)	Argentina	1982	Station	Year-round	20	100
Marambio	Argentina	1969	Station	Year-round	55	150
Matienzo	Argentina	1961	Station	Seasonal		15
Melchior	Argentina	1947	Station	Seasonal		36
Orcadas	Argentina	1904	Station	Year-round	14	45
Petrel	Argentina	1967	Station	Seasonal		55
Primavera	Argentina	1977	Station	Seasonal		18
San Martín	Argentina	1951	Station	Year-round	20	20
Edgeworth David	Australia		Camp	Seasonal		
Wilkins Aerodrome	Australia		Camp	Seasonal		
Casey	Australia	1969	Station	Year-round	20	70
Davis	Australia	1957	Station	Year-round	22	70
Mawson	Australia	1954	Station	Year-round	20	60
Beaver Lake	Australia		Camp			

Law - Racovita - Negoita	Australia & Romania	1987	Station	Seasonal		13
Princess Elisabeth	Belgium	2009	Station	Seasonal		20
Comandante Ferraz	Brazil	1984	Station	Year-round	12	40
Ohridski	Bulgaria	1988	Station	Seasonal		18
Lieutenant Arturo Parodi	Chile	1999	Station	Seasonal		25
Lieutenant Rodolfo Marsh M. Aerodrome	Chile	1969	Camp	Year-round	8	15
Arturo Prat	Chile	1947	Station	Year-round	9	15
Lieutenant Luis Carvajal Villarroel	Chile	1985	Station	Seasonal		30
Julio Escudero	Chile	1994	Station	Year-round	2	26
Eduardo Frei Montalva	Chile	1969	Station	Year-round	70	120
Bernardo O'Higgins Riquelme	Chile	1948	Station	Year-round	16	44
Ripamonti	Chile		Station	Seasonal		
Risopatrón	Chile	1957	Station	Seasonal		8
President Gabriel Gonzalez Videla	Chile	1951	Station	Seasonal		9
Guillermo Mann	Chile	1991	Station	Seasonal		6
Sub Base Yelcho	Chile	1962	Station	Seasonal		
Great Wall	China	1985	Station	Year-round	14	40
Kunlun	China	2009	Station	Seasonal		20
Taishan	China	2014	Camp	Seasonal		5
Zhongshan	China	1989	Station	Year-round	15	30
Johann Gregor Mendel	Czech Republic	2006	Station	Seasonal		20
Refugio Ecuador	Ecuador	1990	Refuge	Seasonal		4
Maldonado	Ecuador	1990	Station	Seasonal		22
Aboa	Finland	1989	Station	Seasonal		20

Cap Prud'homme	France		Camp	Seasonal		20
Dumont d'Urville	France	1956	Station	Year-round	26	100
Concordia	France & Italy	1997	Station	Year-round	13	60
Dallman Lab at Base Carlini	Germany	1994	Station	Seasonal		12
Antarctic Receiving Station (GARS)	Germany		Station	Seasonal		
Gondwana	Germany	1983	Station	Seasonal		
Kohnen	Germany	2001	Station	Seasonal		28
Neumayer III	Germany	1981	Station	Year-round	9	50
Bharati	India	2012	Station	Year-round	15	
Dakshin Gangotri	India	1983	Station	Seasonal		
Maitri	India	1989	Station	Year-round	25	65
Browning Pass	Italy	1997	Camp	Seasonal		2
Enigma Lake	Italy	2005	Camp	Seasonal		
Mid Point	Italy	1998	Camp	Seasonal		
Sitry	Italy	2000	Camp	Seasonal		
Mario Zucchelli	Italy	1986	Station	Seasonal		90
S17	Japan	2005	Camp	Seasonal		
Asuka	Japan	1984	Station	Seasonal		
Dome Fuji	Japan	1995	Station	Seasonal		15
Mizuho	Japan	1970	Station	Seasonal		
Syowa	Japan	1957	Station	Year-round	28	110
King Sejong	Republic of Korea	1988	Station	Year-round	18	70
Jang Bogo	Republic of Korea	2014	Station	Year-round	16	60
Dirck Gerritsz Laboratory	Netherlands & UK	2012		Seaonal		
Scott Base	New Zealand	1957	Station	Year-round	10	85

Tor	Norway	1985	Refuge	Seasonal		4
Troll	Norway	1990	Station	Year-round	7	40
Machu Picchu	Peru	1989	Station	Seasonal		28
Arctowski	Poland	1977	Station	Year-round	12	40
Molodezhnaya Airfield	Russia		Camp	Seasonal		
Novolazarevskaya Airfield	Russia		Camp	Seasonal		
Bellingshausen	Russia	1968	Station	Year-round	25	38
Druzhnaya-4	Russia	1987	Station	Seasonal		50
Leningradskaya	Russia	1971	Station	Seasonal		
Mirny	Russia	1956	Station	Year-round	60	169
Molodezhnaya	Russia	1962	Station	Seasonal		
Novolazarevskaya	Russia	1961	Station	Year-round	30	70
Progress	Russia	1989	Station	Year-round	20	77
Russkaya	Russia	1980	Station	Seasonal		
Soyuz	Russia	1982	Station	Seasonal		
Vostok	Russia	1957	Station	Year-round	13	25
SANAE IV	South Africa	1962	Station	Year-round	10	80
Gabriel de Castilla	Spain	1990	Station	Seasonal		25
Juan Carlos I	Spain	1989	Station	Seasonal		25
Svea	Sweden		Station	Seasonal		
Wasa	Sweden	1989	Station	Seasonal		20
Vernadsky	Ukraine	1996	Station	Year-round	12	24
Fossil Bluff	United Kingdom	1961	Camp	Seasonal		6
Rothera Skiway	United Kingdom	1975	Camp	Seasonal		
Sky Blu	United Kingdom		Camp	Seasonal		6
Halley	United Kingdom	1956	Station	Year-round	15	65
Rothera	United Kingdom	1975	Station	Year-round	22	130

Signy	United Kingdom	1947	Station	Seasonal		10
Artigas	Uruguay	1984	Station	Year-round	9	60
Ruperto Elichiribehety	Uruguay	1997	Station	Seasonal		
Marble Point Heliport	USA		Camp	Seasonal		
Odell Glacier Camp	USA		Camp	Seasonal		
Siple Dome	USA		Camp	Seasonal		
Amundsen-Scott South Pole Station	USA	1956	Station	Year-round	75	250
McMurdo Station	USA	1955	Station	Year-round	250	1000
Palmer Station	USA	1965	Station	Year-round	12	43

Note. Adapted from Council of Managers of National Antarctic Programs (2014). *Antarctic Facilities List.* Retrieved from https://www.comnap.aq/Information/SitePages/Home.aspx

Appendix B

	Station									
	South Pole		Vostok		Arctowski		Great Wall		Maitri	
Month	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Depression										
March-June	4.80	5.61	4.07†	7.35	5.30	6.88	6.29	7.05	8.52‡	7.78
July-October	4.50	5.73	3.45‡§	8.54	5.49	8.14	6.44*	7.01	7.19‡	6.53
Anxiety										
March-June	4.95	4.12	7.40‡	4.06	5.68	4.31	5.83	4.41	5.84	4.41
July-October	5.59§	3.98	6.74†§	4.14	5.80	4.77	5.87	4.52	5.66	4.79
Anger										
March-June	4.99	6.09	5.72	6.41	6.32*	7.14	5.14	5.21	6.48*	5.84
July-October	5.28	6.43	4.99	7.01	6.66	7.83	5.44	7.47	4.80§	5.14
Confusion										
March-June	4.16	5.12	4.58	3.49	4.51	3.09	5.63‡	3.62	4.79	3.98
July-October	4.19	2.95	3.96§	3.78	4.67	3.78	5.69‡	3.98	4.34	3.82
Fatigue										
March-June	5.26	4.76	3.30‡	3.96	4.19*	4.19	4.10*	3.97	5.43	4.83
July-October	6.07§	5.12	2.28‡	4.16	4.26‡	4.67	3.75‡	4.05	3.77‡§	4.07
Vigor										
March-June	17.36	5.83	13.91‡	5.05	15.56†	6.63	15.37†	5.60	20.43‡	5.37
July-October	16.28§	6.38	13.52‡	6.27	15.61	6.64	14.49*	6.72	20.96‡	5.27

Comparisons with South Pole: $^{*}p < 0.05$, $^{\dagger}p < 0.01$, $^{\ddagger}p < 0.001$.
Comparisons by month: $^{\S}p < 0.05$.

Note. South Pole = American personnel. Vostok = Russian. Arctowski = Poland. Great Wall = China. Maitri = China. Taken from Palinkas, L. A., Johnson, J. C., Boster, J. S., Rakusa-Suszczewski, S., Klopov, V. P., Fu, X. Q., & Sachdeva, U. (2004). Cross-cultural differences in psychosocial adaptation to isolated and confined environments. *Aviation, space, and environmental medicine*, *75*(11), 973-980. Retrieved from: http://www.ingentaconnect.com/content/asma/asem/2004/00000075/00000011/art00008.

Appendix C

PRISMA Checklist for Systematic Reviews and Meta-Analyses

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	I
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	1
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	11
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	11
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	12
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	12-13
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	12
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	12
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	12-13
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	14-15
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	12
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	16, 22-23
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	15
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	15-23

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	23
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	21-22
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	14
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	32,43,51,58
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	24,35,44,50
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	35,41,54,62
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	23,35,44,50
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	24,35,44,50
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	58-61
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	63-71
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	71-75
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	75
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	N/A

Note. Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. G. (2009). Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *Annals of internal medicine*, *151*(4), 264-269. doi:10.7326/0003-4819-151-4-200908180-00135

Appendix D

Sensitivity Analysis of Data included in Analysis One

Author	Timepoint	SS	Pre M	Pre SD	Post M	Post SD	Cohen's *d* at .25 correlation	Cohen's d at .5 Correlation	% change in estimate	Cohen's d at .75 Correlation	% change in estimate
Norris, 2010	March-April	279	6.69	10.51	10.51	3.28	0.277	0.274	-1.08%	0.267	-2.55%
	March-May	259	6.69	10.51	10.44	3.71	0.232	0.228	-1.72%	0.215	-5.07%
	March-June	223	6.69	10.51	10.09	3.47	0.130	0.128	-1.54%	0.123	-3.91%
	March-July	225	6.69	10.51	10.18	3.37	0.162	0.161	-0.62%	0.155	-3.73%
	March-August	212	6.69	10.51	9.83	2.74	0.053	0.053	0.00%	0.052	-1.89%
	March-September	200	6.69	10.51	10.07	3.1	0.133	0.132	-0.75%	0.130	-1.51%
	March-October	139	6.69	10.51	9.73	3.24	0.014	0.013	-7.14%	0.013	0%
Oliver, 1991	March-April	31	6.13	2.15	6.77	2.43	0.281	0.280	-0.36%	0.278	-0.71%
	March-May	31	6.13	2.15	5.48	1.50	-0.344	-0.338	-1.74%	-0.320	-5.32%
	March-June	31	6.13	2.15	6.45	2.31	0.145	0.144	-0.69%	0.144	0%
	March-August	31	6.13	2.15	6.13	2.13	0.000	0.000	0.00%	0.000	0%
Weiss et al., 2004	March-April	28	6.61	5.38	6.82	6.59	0.035	0.035	0.00%	0.034	-2.86%
	March-May	28	6.61	5.38	4.18	3.13	-0.541	-0.520	-3.88%	-0.468	-10.00%
	March-June	28	6.61	5.38	6.25	4.53	-0.072	-0.072	0.00%	-0.071	-1.39%
	March-July	28	6.61	5.38	2.96	4.03	-0.763	-0.753	-1.31%	-0.726	-3.58%

	March-August	28	6.61	5.38	4.14	4.76	-0.486	-0.485	-0.20%	-0.485	0%
	March-September	28	6.61	5.38	4.39	4.32	-0.454	-0.450	-0.88%	-0.440	-2.22%
	March-October	28	6.61	5.38	3.61	3.97	-0.630	-0.621	-1.43%	-0.596	-4.02%
Palinkas et al., 2000a*	March-April	62					-0.261	-0.256	-1.91%	-0.244	-4.69%
	March-May	62					-0.068	-0.067	-1.47%	-0.067	0%
	March-June	62					0.135	0.134	-0.74%	0.132	-1.50%
	March-July	62					-0.237	-0.230	-2.95%	-0.212	-7.83%
	March-August	62					-0.079	-0.075	-5.06%	-0.067	-10.67%
Palinkas et al., 2000b*	March-April	18					-0.202	-0.202	0%	-0.202	0%
	March-May	18					-0.154	-0.154	0%	-0.154	0%
	March-June	18					-0.420	-0.392	-6.66%	-0.336	-14.28%
	March-July	18					-0.277	-0.224	-19.13%	-0.216	-3.57%
	March-August	18					-0.803	-0.741	-7.72%	-0.624	-15.79%
	March-September	18					-0.148	-0.145	-2.03%	-0.137	-5.52%
	March-October	18					-0.119	-0.122	2.52%	-0.126	3.28%

Note. SS = Sample Size, *r* = pre-post correlation. * = Composite Effect Size used.

Appendix E

Sensitivity Analysis of Data included in Analysis Two

Author	Timepoint	SS	Pre M	Pre SD	Post M	Post SD	Cohen's *d* at .25 correlation	Cohen's d at .5 Correlation	% change in estimate	Cohen's d at .75 Correlation	% change in estimate
Norris, 2010	March-April	279	9.69	2.58	10.51	3.28	0.277	0.274	-1.08%	0.267	-2.550
	April-May	259	10.51	3.28	10.44	3.71	-0.020	-0.020	0%	-0.020	0%
	May-June	223	10.44	3.71	10.09	3.47	-0.097	-0.097	0%	-0.097	0%
	June-July	225	10.09	3.47	10.18	3.37	0.026	0.026	0%	0.026	0%
	July-August	212	10.18	3.37	9.83	2.74	-0.114	-0.113	-0.88%	-0.111	-1.77%
	August-September	200	9.83	2.74	10.07	3.1	0.082	0.082	0%	0.081	-1.22%
	September-October	139	10.07	3.1	9.73	3.29	-0.106	-0.106	0%	-0.106	0%
Oliver, 1991	March-April	31	6.13	2.13	6.77	2.43	0.280	0.280	0%	0.277	-1.07%
	April-May	31	6.77	2.43	5.48	1.50	-0.626	-0.605	-3.35%	-0.555	-8.26%
	May-June	31	5.48	1.50	6.45	2.31	0.490	0.477	-2.65%	0.443	-7.13%
Weiss et al., 2004	March-April	28	6.61	5.37	6.82	6.589	0.035	0.035	0.00%	0.034	-2.86%
	April-May	28	6.82	6.59	4.18	3.128	-0.494	-0.462	-6.48%	-0.395	-14.50%

	May-June	28	4.18	3.13	6.25	4.527	0.526	0.516	-1.90%	0.487	-5.62%
	June-July	28	6.25	4.53	2.96	4.032	-0.767	-0.766	-0.13%	-0.761	-0.65%
	July-August	28	2.96	4.03	4.14	4.759	0.267	0.266	-0.37%	0.262	-1.50%
	August-September	28	4.14	4.76	4.39	4.315	0.055	0.055	0%	0.055	0%
	September-October	28	4.39	4.32	3.61	3.966	-0.188	-0.188	0%	-0.187	-0.53%
Palinkas et al., 2000a*	March-April	18					-0.202	-0.202	0%	-0.202	0%
	April-May	18					0.043	0.043	0%	0.042	-2.32%
	May-June	18					-0.241	-0.227	-5.81%	-0.197	-13.21%
	June-July	18					0.101	0.086	-14.85%	0.059	-31.14%
	July-August	18					-0.378	-0.345	-8.73%	-0.288	-16.52%
	August-September	18					0.455	0.411	-9.67%	0.337	18%
	September-October	18					0.107	0.105	-1.87%	0.102	-2.86%
Palinkas et al., 2000b*	March-April	62					-0.261	-0.256	-1.91%	-0.244	-4.69%
	April-May	62					0.158	0.152	-3.80%	0.137	-9.87%
	May-June	62					0.189	0.188	-0.53%	0.186	-1.06%
	June-July	62					-0.381	-0.365	-4.20%	-0.327	-10.41%
	July-August	62					0.152	0.148	-2.63%	0.138	-6.76%

Palinkas et al., 2000c*	May-June	7	-0.085	-0.083	-2.35%	-0.079	-4.82%
	June-July	7	0.326	0.313	-3.99%	0.283	-9.58%
	July-August	7	-0.321	-0.307	-4.36%	-0.274	-10.75%
	August-September	7	-0.055	-0.054	-1.82%	-0.050	-7.41%
	September-October	7	-0.096	-0.094	-2.08%	-0.091	-3.20%

Note. SS = Sample Size. * = Composite Effect Size used.

Appendix F

Sensitivity Analysis of Data included in Analysis Three and Four

Analysis	Authors	SS	Pre M	Pre SD	Post M	Post SD	Cohen's *d* at .25 correlation	Cohen's d at .5 Correlation	% change in estimate	Cohen's d at .75 Correlation	% change in estimate
Analysis Three	Bhargava et al., 2000 *	25	7	-	25	-	-0.838	-0.838	0%	-0.838	0%
	Harris et al., 2010*	40	10	-	40	-	-0.302	-0.302	0%	-0.302	0%
	Ikegawa et al., 1998	8	21.4	5.6	20	3.6	-0.293	-0.285	2.78%	-0.264	7.37%
	McCormick et al., 1985	11	74.08	16.61	72.82	17.95	-0.073	-0.073	0.03%	-0.073	0.45%
	Norris, 2010	333	9.69	3.114	12.22	11.166	0.286	0.254	11.50%	0.197	19.88%
	Palinkas et al., 1995	91	7.74	6.47	11.85	8.72	0.532	0.524	1.38%	0.504	3.78%
	Palinkas et al., 1995a	89	7.54	6.47	11.85	8.72	0.557	0.55	1.38%	0.528	3.87%
	Palinkas et al., 1996	67	4.5	5	4.4	4.4	-0.021	-0.021	0.47%	-0.021	0.47%
	Weiss et al., 2000a	31	22.75	5.4	24.46	4.8	0.334	0.334	0.23%	0.331	0.89%
	Weiss et al., 2000b	36	26.54	9.21	26.28	10.1	-0.027	-0.027	0.37%	-0.027	0.25%
	Weiss et al.,	40	25.65	7.24	26.93	9.23	0.154	0.154	0%	0.152	1.29%

	2000c										
Analsyis Four	Ursin et al., 1991	20	1.43	0.3	1.37	0.29	-0.203	-0.203	0%	-0.203	0%
	Norris et al., 2010	90	9.88	3.17	11.9	3.19	0.635	0.635	0%	0.635	0%

Note. SS = Sample Size. * = Descriptive Statistic used was a Frequency.

Appendix G

Composite Effect Sizes for Data included in Analysis One

Authors	Time-point	Outcome	Pre M	Pre SD	Post M	Post SD	*r*	SS	Cohen's *d*	std error	Composite Cohen's *d*	std error
Palinkas et al., 2000a	March-April	Anger	4.2	4.8	3.4	5.4	0.5	18	-0.16	0.24	-0.2	0.24
		Anxiety	5.6	3.8	4.9	3.9	0.5	18	-0.18	0.24		
		Confusion	4.4	2.4	3.5	2.6	0.5	18	-0.36	0.24		
		Depression	5.4	5.6	3.7	5.2	0.5	18	-0.31	0.24		
		Fatigue	5.9	3.3	5.9	4.8	0.5	18	0.00	0.24		
	March-May	Anger	4.2	4.8	2.7	4.4	0.5	18	-0.33	0.24	-0.15	0.24
		Anxiety	5.6	3.8	4.8	3.9	0.5	18	-0.21	0.24		
		Confusion	4.4	2.4	4.2	3.4	0.5	18	-0.07	0.24		
		Depression	5.4	5.6	4.3	4.9	0.5	18	-0.21	0.24		
		Fatigue	5.9	3.3	6.1	6.4	0.5	18	0.04	0.24		
	March-June	Anger	4.2	4.8	1.4	1.7	0.5	18	-0.66	0.26	-0.39	0.25
		Anxiety	5.6	3.8	3.5	1.7	0.5	18	-0.64	0.26		
		Confusion	4.4	2.4	3.8	3	0.5	18	-0.22	0.24		
		Depression	5.4	5.6	3	3.1	0.5	18	-0.49	0.25		
		Fatigue	5.9	3.3	6.2	6.5	0.5	18	0.05	0.24		
	March-July	Anger	4.2	4.8	3.1	6.3	0.5	18	-0.19	0.24	-0.22	0.24
		Anxiety	5.6	3.8	4.4	4.4	0.5	18	-0.29	0.24		
		Confusion	4.4	2.4	3.3	3.3	0.5	18	-0.37	0.24		
		Depression	5.4	5.6	4	7.7	0.5	18	-0.20	0.24		
		Fatigue	5.9	3.3	5.6	5.6	0.5	18	-0.06	0.24		
	March-	Anger	4.2	4.8	1.1	2.2	0.5	18	-0.74	0.27	-0.15	0.24

	August											
		Anxiety	5.6	3.8	2.8	1.3	0.5	18	-0.84	0.27		
		Confusion	4.4	2.4	2.7	1.4	0.5	18	-0.81	0.27		
		Depression	5.4	5.6	1.6	1.1	0.5	18	-0.74	0.27		
		Fatigue	5.9	3.3	3.4	5	0.5	18	-0.57	0.25		
	March-September	Anger	4.2	4.8	3.2	6.5	0.5	18	-0.17	0.24	-0.15	0.24
		Anxiety	5.6	3.8	5.3	4.5	0.5	18	-0.07	0.24		
		Confusion	4.4	2.4	3.8	3.8	0.5	18	-0.18	0.24		
		Depression	5.4	5.6	4.4	8	0.5	18	-0.14	0.24		
		Fatigue	5.9	3.3	5.2	4.9	0.5	18	-0.16	0.24		
	March-October	Anger	5.4	5.6	4.3	7.6	0.5	18	-0.16	0.24	-0.12	0.24
		Anxiety	5.9	3.3	5.9	3.8	0.5	18	0.00	0.24		
		Confusion	4.4	2.4	3.5	2.8	0.5	18	-0.34	0.24		
		Depression	5.6	3.8	4.2	4.3	0.5	18	-0.34	0.24		
		Fatigue	5.9	3.3	7.4	7.2	0.5	18	0.24	0.24		
Palinkas et al., 2000b	March-April	Anger	3.4	4.3	3	2.7	0.5	62	-0.11	0.13	-0.26	0.13
		Anxiety	5.8	3.2	4.4	2.6	0.5	62	-0.48	0.13		
		Confusion	4	2.6	3.1	2	0.5	62	-0.38	0.13		
		Depression	4.2	5.5	3.1	2.9	0.5	62	-0.23	0.13		
		Fatigue	5	5.1	4.6	4	0.5	62	-0.09	0.13		
	March-May	Anger	3.4	4.3	3.8	5.9	0.5	62	0.08	0.13	-0.07	0.13
		anxiety	5.8	3.2	4.9	4.1	0.5	62	-0.24	0.13		
		Confusion	4	2.6	3.3	2.6	0.5	62	-0.27	0.13		
		Depression	4.2	5.5	4	6.6	0.5	62	-0.03	0.13		
		fatigue	5	5.1	5.7	5.6	0.5	62	0.13	0.13		

March-June	Anger	3.4	4.3	5.1	5.7	0.5	62	0.33	0.13	0.13	0.13
	Anxiety	5.8	3.2	5.7	3.4	0.5	62	-0.03	0.13		
	Confusion	4	2.6	4.1	3.1	0.5	62	0.03	0.13		
	Depression	4.2	5.5	4.3	4.3	0.5	62	0.02	0.13		
	Fatigue	5	5.1	6.7	5.6	0.5	62	0.32	0.13		
March-July	Anger	3.4	4.3	3.1	2.5	0.5	62	-0.08	0.13	-0.23	0.13
	Anxiety	5.8	3.2	4.3	2.1	0.5	62	-0.53	0.14		
	Confusion	4	2.6	3.2	1.8	0.5	62	-0.35	0.13		
	Depression	4.2	5.5	3.3	2.7	0.5	62	-0.19	0.13		
	Fatigue	5	5.1	5	3.4	0.5	62	0.00	0.13		
March-August	Anger	3.4	4.3	3.7	3.7	0.5	62	0.07	0.13	-0.08	0.13
	Anxiety	5.8	3.2	5.3	2.8	0.5	62	-0.17	0.13		
	Confusion	4	2.6	3.8	3	0.5	62	-0.07	0.13		
	Depression	4.2	5.5	3	2.5	0.5	62	-0.25	0.13		
	Fatigue	5	5.1	5.2	5	0.5	62	0.04	0.13		

Note. SS = Sample Size, *r* = pre-post correlation.

Appendix H

Composite Effect Sizes for Data included in Analysis Two

Author	Timepoint	Outcome	Pre M	Pre SD	Post M	Post SD	*r*	SS	cohen's *d*	std error	Composite Cohen's *d*	std error
Palinkas et al., 2000a	March-April	Anger	4.2	4.8	3.4	5.4	0.5	18	-0.16	0.24	-0.2	0.24
		Anxiety	5.6	3.8	4.9	3.9	0.5	18	-0.18	0.24		
		Confusion	4.4	2.4	3.5	2.6	0.5	18	-0.36	0.24		
		Depression	5.4	5.6	3.7	5.2	0.5	18	-0.31	0.24		
		Fatigue	5.9	3.3	5.9	4.8	0.5	18	0.00	0.24		
	April-May	Anger	3.4	5.4	2.7	4.4	0.5	18	-0.14	0.24	0.04	0.24
		Anxiety	4.9	3.9	4.8	3.9	0.5	18	-0.03	0.24		
		Confusion	3.5	2.6	4.2	3.4	0.5	18	0.23	0.24		
		Depression	3.7	5.2	4.3	4.9	0.5	18	0.12	0.24		
		Fatigue	5.9	4.8	6.1	6.4	0.5	18	0.03	0.24		
	May-June	Anger	2.7	4.4	1.4	1.7	0.5	18	-0.34	0.24	-0.23	0.24
		Anxiety	4.8	3.9	3.5	1.7	0.5	18	-0.38	0.24		
		Confusion	4.2	3.4	3.8	3	0.5	18	-0.12	0.24		
		Depression	4.3	4.9	3	3.1	0.5	18	-0.30	0.24		
		Fatigue	6.1	6.4	6.2	6.5	0.5	18	0.02	0.24		
	June-July	Anger	1.4	1.7	3.1	6.3	0.5	18	0.30	0.24	0.09	0.24
		Anxiety	3.5	1.7	4.4	4.4	0.5	18	0.23	0.24		
		Confusion	3.8	3	3.3	3.3	0.5	18	-0.16	0.24		
		Depression	3	3.1	4	7.7	0.5	18	0.15	0.24		
		Fatigue	6.2	6.5	5.6	5.6	0.5	18	-0.10	0.24		

	July-August	Anger	3.1	6.3	1.1	2.2	0.5	18	-0.36	0.24	-0.35	0.24
		Anxiety	4.4	4.4	2.8	1.3	0.5	18	-0.41	0.25		
		Confusion	3.3	3.3	2.7	1.4	0.5	18	-0.21	0.24		
		Depression	4	7.7	1.6	1.1	0.5	18	-0.33	0.24		
		Fatigue	5.6	5.6	3.4	5	0.5	18	-0.41	0.25		
	August-September	Anger	1.1	2.2	3.2	6.5	0.5	18	0.37	0.24	0.41	0.25
		Anxiety	2.8	1.3	5.3	4.5	0.5	18	0.62	0.26		
		Confusion	2.7	1.4	3.8	3.8	0.5	18	0.33	0.24		
		Depression	1.6	1.1	4.4	8	0.5	18	0.37	0.24		
		Fatigue	3.4	5	5.2	4.9	0.5	18	0.36	0.24		
	September-October	Anger	3.2	6.5	4.3	7.6	0.5	18	0.15	0.24	0.11	0.24
		Anxiety	5.3	4.5	5.9	3.8	0.5	18	0.14	0.24		
		Confusion	3.8	3.8	3.5	2.8	0.5	18	-0.09	0.24		
		Depression	4.4	8	4.2	4.3	0.5	18	-0.03	0.24		
		Fatigue	5.2	4.9	7.4	7.2	0.5	18	0.35	0.24		
Palinkas et al., 2000b	March-April	Anger	3.4	4.3	3	2.7	0.5	62	-0.11	0.13	-0.26	0.13
		Anxiety	5.8	3.2	4.4	2.6	0.5	62	-0.48	0.13		
		Confusion	4	2.6	3.1	2	0.5	62	-0.38	0.13		
		Depression	4.2	5.5	3.1	2.9	0.5	62	-0.23	0.13		
		Fatigue	5	5.1	4.6	4	0.5	62	-0.09	0.13		
	April-May	Anger	3	2.7	3.8	5.9	0.5	62	0.16	0.13	0.15	0.13
		Anxiety	4.4	2.6	4.9	4.1	0.5	62	0.14	0.13		

		Confusion	3.1	2	3.3	2.6	0.5	62	0.08	0.13		
		Depression	3.1	2.9	4	6.6	0.5	62	0.16	0.13		
		Fatigue	4.6	4	5.7	5.6	0.5	62	0.22	0.13		
	May-June	Anger	3.8	5.9	5.1	5.7	0.5	62	0.22	0.13	0.19	0.19
		Anxiety	4.9	4.1	5.7	3.4	0.5	62	0.21	0.13		
		Confusion	3.3	2.6	4.1	3.1	0.5	62	0.28	0.13		
		Depression	4	6.6	4.3	4.3	0.5	62	0.05	0.13		
		Fatigue	5.7	5.6	6.7	5.6	0.5	62	0.18	0.13		
	June-July	Anger	5.1	5.7	3.1	2.5	0.5	62	-0.40	0.13	-0.37	0.13
		Anxiety	5.7	3.4	4.3	2.1	0.5	62	-0.47	0.13		
		Confusion	4.1	3.1	3.2	1.8	0.5	62	-0.33	0.13		
		Depression	4.3	4.3	3.3	2.7	0.5	62	-0.27	0.13		
		Fatigue	6.7	5.6	5	3.4	0.5	62	-0.35	0.13		
	July-August	Anger	3.1	2.5	3.7	3.7	0.5	62	0.18	0.13	0.03	0.13
		Anxiety	4.3	2.1	5.3	2.8	0.5	62	0.40	0.13		
		Confusion	3.2	1.8	3.8	3	0.5	62	0.23	0.13		
		Depression	3.3	2.7	3	2.5	0.5	62	-0.12	0.13		
		Fatigue	5	3.4	5.2	5	0.5	62	0.05	0.13		
Palinkas et al., 2000c	May-June	Anger	2.2	1.9	2	2.8	0.5	7	-0.08	0.38	-0.08	0.39
		Anxiety	5.2	4.7	4.5	2.9	0.5	7	-0.17	0.38		
		Confusion	4.6	3.3	3.6	1.9	0.5	7	-0.35	0.39		
		Depression	3.2	3.8	2.2	2.8	0.5	7	-0.29	0.39		
		Fatigue	3.5	3.8	6.2	6.5	0.5	7	0.48	0.40		
	June-July	Anger	2	2.8	4.3	5.3	0.5	7	0.50	0.40	0.31	0.39
		Anxiety	4.5	2.9	5.5	4.8	0.5	7	0.24	0.38		
		Confusion	3.6	1.9	5.1	3.3	0.5	7	0.52	0.40		

	Depression	2.2	2.8	2.5	5.2	0.5	7	0.07	0.38		
	Fatigue	6.2	6.5	8	8.4	0.5	7	0.24	0.38		
July-August	Anger	4.3	5.3	3	5.4	0.5	7	-0.24	0.38	-0.31	0.39
	Anxiety	5.5	4.8	3.3	2.4	0.5	7	-0.53	0.40		
	Confusion	5.1	3.3	4.7	2.3	0.5	7	-0.14	0.38		
	Depression	2.5	5.2	2.1	3.2	0.5	7	-0.09	0.38		
	Fatigue	8	8.4	4.1	4.1	0.5	7	-0.54	0.40		
August-September	Anger	3	5.4	4.2	4.8	0.5	7	0.23	0.38	-0.05	0.39
	Anxiety	3.3	2.4	4.4	3	0.5	7	0.40	0.39		
	Confusion	4.7	2.3	3.4	1.9	0.5	7	-0.61	0.41		
	Depression	2.1	3.2	1.9	2.2	0.5	7	-0.07	0.38		
	Fatigue	4.1	4.1	3.3	2.7	0.5	7	-0.22	0.38		
September-October	Anger	4.2	4.8	3.9	5.6	0.5	7	-0.06	0.38	-0.09	0.38
	Anxiety	4.4	3	3.6	2.3	0.5	7	-0.29	0.39		
	Confusion	3.4	1.9	3.4	2.5	0.5	7	0.00	0.38		
	Depression	1.9	2.2	2	2.3	0.5	7	0.04	0.38		
	Fatigue	3.3	2.7	2.9	2	0.5	7	-0.16	0.38		

Note. SS = Sample Size, *r* = pre-post correlation.

Appendix J

Composite Effect Sizes for Data included in Analysis Three and Four

Analysis	Author	Subscale	Pre M	Pre SD	Post M	Post SD	*r*	SS	Cohen's *d*	Std Error	Composite Cohen's *d*	Std Error
Analysis Three	Khandelwal et al., 2015	Anxiety					0.5		0.14	0.17	-0.19	0.18
		Depression					0.5		-0.51	0.19		
	Peri et al., 2000	Anger	43.09	3.75	43.91	5.11	0.5	11	0.18	0.30	0.28	0.31
		Confusion	37.27	4.24	40.36	6.6	0.5	11	0.53	0.32		
		Depression	42.09	1.14	42.55	1.75	0.5	11	0.30	0.31		
		Fatigue	40.18	2.93	42.91	6.73	0.5	11	0.47	0.32		
		Tension	41.73	4.41	41.45	4.13	0.5	11	-0.07	0.30		
Analysis Four	Chen et al., 2016a	Anger	1.83	1.95	2	1.71	0.5	12	0.09	0.29	0.29	0.31
		Confusion	4.08	2.23	6.17	3.1	0.5	12	0.75	0.33		
		Depression	3.25	3.14	2.42	2.61	0.5	12	-0.29	0.29		
		Fatigue	1.83	2.29	4.08	3.32	0.5	12	0.76	0.33		
		Tension	4.33	2.15	4.67	2.53	0.5	12	0.14	0.29		
	Chen et al., 2016b	Anger	4.63	3.98	6.81	5.49		16	0.44	0.26	0.36	0.26
		Confusion	4.88	2.83	5.44	3.05	0.5	16	0.19	0.25		
		Depression	4.75	3.77	6.75	6.57	0.5	16	0.35	0.26		
		Fatigue	2.94	2.49	4.69	3.11	0.5	16	0.61	0.27		
		Tension	5	2.45	5.69	4.11	0.5	16	0.19	0.25		

Note. SS = Sample Size, *r* = pre-post correlation.

Appendix I

Hofstede's Individualism Index (IDV) values for 50 Countries and 3 Regions

Score Rank	Country or Region	IDV Score	Score Rank	Country or Region3	IDV Score
1	USA	91	28	Turkey	37
2	Australia	90	29	Uruguay	36
3	Great Britain	89	30	Greece	35
4/5	Canada	80	31	Philippines	32
4/5	Netherlands	80	32	Mexico	30
6	New Zealand	79	33/35	East Africa	27
7	Italy	76	33/35	Yugoslavia	27
8	Belgium	75	33/35	Portugal	27
9	Denmark	74	36	Malaysia	26
10/11	Sweden	71	37	Hong Kong	25
10/11	France	71	38	Chile	23
12	Ireland (Rep)	70	39/41	West Africa	20
13	Norway	69	39/41	China	20
14	Switzerland	68	39/41	Thailand	20
15	Germany (F.R)	67	42	Salvador	19
16	South Africa	65	43	South Korea	18
17	Finland	63	44	Taiwan	17
18	Austria	55	45	Peru	16
19	Israel	54	46	Costa Rica	15
20	Spain	51	47/48	Pakistan	14
21	India	48	47/48	Indonesia	14
22/23	Japan	46	49	Colombia	13
22/23	Argentina	46	50	Venezuela	12
24	Iran	41	51	Panama	11
25	Jamaica	39	52	Equador	8
26/27	Brazil	38	53	Guatemala	6
26/27	Arab Countries	38			

Note: Adapted from Hofstede, G., Hofstede, G. J., & Minkov, M. (1991). *Cultures and organizations: Software of the mind* (Vol. 2). London: McGraw-Hill.